THE ENGINEER.

# The British Industries Fair at Birmingham.

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In this our second special Supplement we continue our account of some of the exhibits being shown at the British Industries Fair, Birmingham. The Fair was opened last Monday, February 20th, and will remain open until Friday, March 2nd.

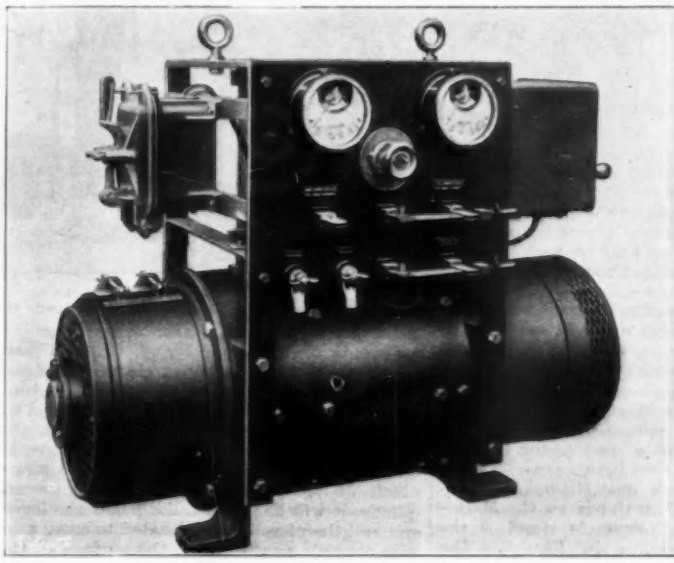


Fig. 1—Portable Arc Welding Set—Metropolitan-Vickers

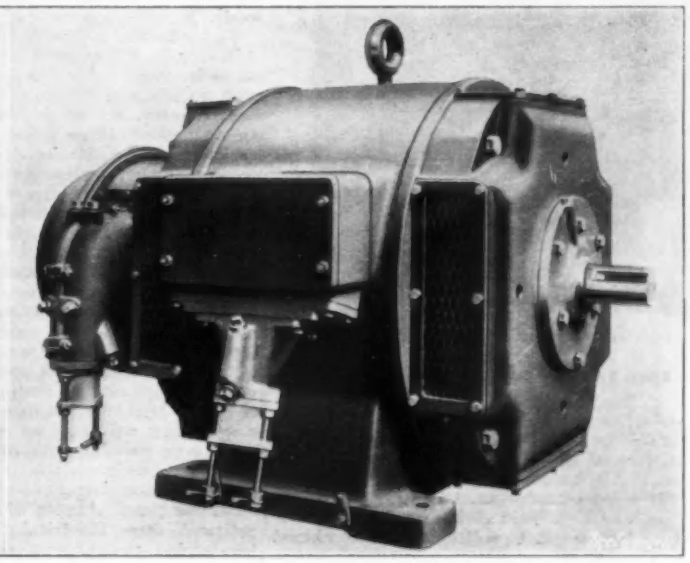
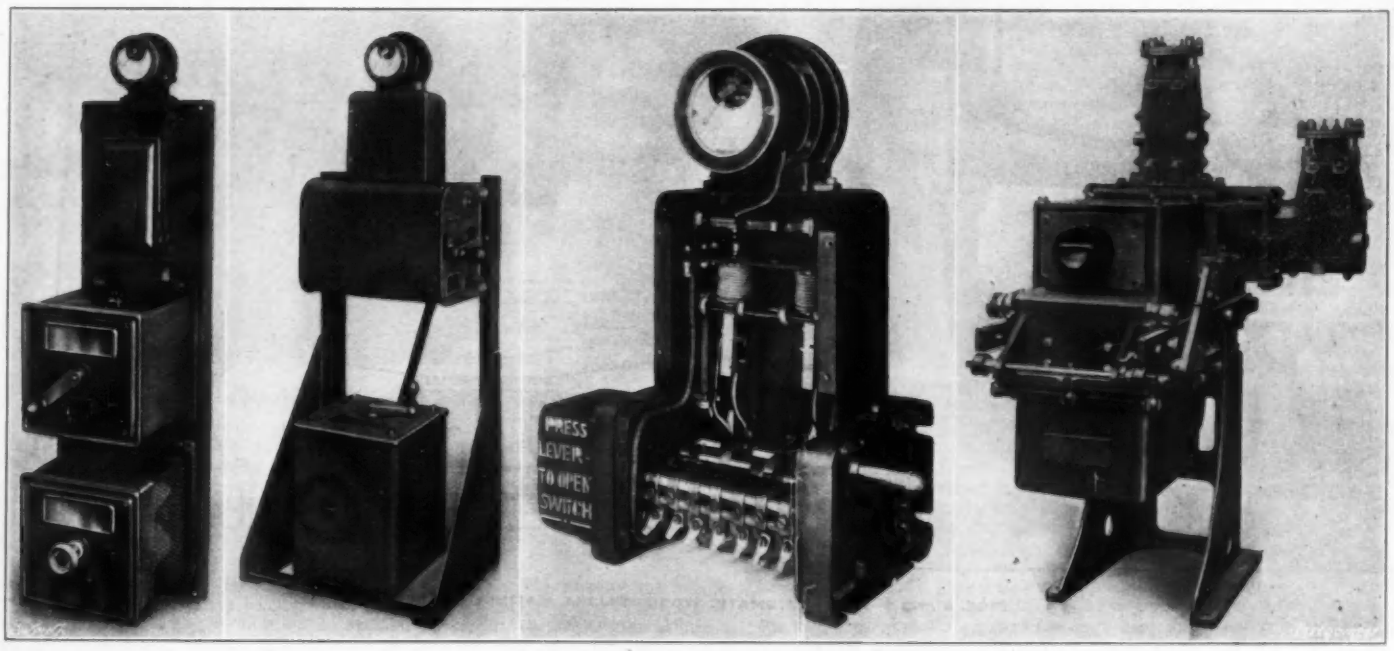


Fig. 2—Slip-Ring Motor—Metropolitan-Vickers

### Metropolitan-Vickers Electrical Company, Ltd.

The new portable single-operator arc welding set shown in Fig. 1 is being exhibited by the Metropolitan-Vickers Electrical Company, Ltd., of Manchester. It has been designed so that it can be brought close to the work, even where little space is available. As shown in the illustration, the generator and motor are mounted in a single case which carries the control gear. The complete unit is 51in. long, 34in. wide, and 39in. high, and weighs 1400 lb. It can easily be transported on a small truck which forms part of the standard equipment, or it can be lifted and carried to the work independently. The generator is rated at 175 ampères at 25/80 volts. The self-stabilising characteristics of the dynamo maintain an arc that gives a constant heating effect without the use of resistances. Practical demonstrations are being carried out with one of the company's welding sets.

Metrovick D.C. motors in sizes ranging from ¼ horse-power to 250 horse-power are on view. There are also squirrel-cage induction motors with ball and roller bearings. Motors of this type, as well as those with wound rotors as shown in Fig. 2, are constructed so that they can be dismantled and reassembled without disturbing the press fits of the bearings, and another feature is the use of standard end brackets, which can be adapted or converted to suit any desired type of enclosure. Crane and elevator alternating-current motors exhibited have the desirable feature of gradually increasing the torque from full speed down to zero speed. Small motors developing approximately ¼ horse-power and for working on alternating-current or direct-current supplies have been developed for driving washing, bacon slicing, cream separating and other machines. These motors are designed in accordance with the latest practice. They have ball bearings, and a centrifugal starting switch is provided on machines that are intended to operate on single-phase circuits. A repulsion motor shown is particularly suitable for driving pumps, refrigerators and other machines that have to be started under load. A $\frac{1}{10}$ horse-power




Figs. 3 to 6—Starting and Control Equipment—Metropolitan-Vickers

direct-current motor on the stand has been designed for driving recording tape machines, advertising signs, dentists' drills, &c. A loom motor is also exhibited. For the individual driving of looms these motors are made in sizes ranging from ¼ to 2 H.P. They are made

for two or three-phase circuits and for pressures up to 500 volts and frequencies up to 60 cycles per second. The motors can be arranged for a belt, chain or gear drive. A special drive has been developed to give the loom a more vigorous start than slow-speed clutches can give, and it is said to reduce the time and energy required to bring the loom up to full speed. The drive consists of a combined pinion sprocket wheel and centrifugal clutch mounted on the motor shaft. When starting the motor accelerates freely to about 70 per cent. of full speed when the clutch engages.

New ironclad starting and control panels for direct-current motors up to 50 horse-power at pressures up

Fig. 7—Low-Tension Switchboard—Metrovick

to 500 volts have been developed, and one of these panels suitable for use with a variable-speed 15 horse-power motor is shown. The equipment, which is seen in Fig. 3, includes a protected type starter fitted with a no-volt release, an adjustable overload release, and a rheostat giving regulation on the motor from half speed to full speed. A combined switch and fuses are arranged so that the fuses are only accessible when the switch is open. The equipment thus not only gives protection, but also provides means of isolating the motor, as required by the Home Office Factory Acts electricity regulations. If necessary, an ammeter can be fitted as shown in Fig. 3.

Starting and control panels for slip-ring motors up to 150 horse-power and at pressures up to 750 volts have also been developed and a floor mounting pillar for a 20 horse-power motor is shown. The equipment consists of a rotor starter and a circuit breaker with a no-volt release, overload releases and, if necessary, an ammeter mounted at the top of the panel, as shown in Fig. 4. The rotor starter is of the face-plate variety, the resistance being immersed in a tank of oil. The contacts are sufficiently numerous to ensure smooth acceleration, and by means of a glass window in the cover they can be inspected at any time. All the parts subject to wear are interchangeable and can easily be renewed. The air break circuit breaker, which is built on the drum principle, gives a double break on each phase. Adjustable compression springs are fitted to the contacts on the drum to ensure smooth operation when the automatic releases come into action. All the contacts are easily renewed at a trifling cost and all the parts are interchangeable. A no-volt release is fitted, and two or three overload releases as required. The circuit breaker can also be hand tripped by means of a push button or it can be electrically tripped from a distance. As in the case of the direct-current apparatus, the equipment constitutes a fully ironclad control unit which gives effective operation and complete protection.

A starting switch for a 10 horse-power squirrel-cage motor, shown in Fig. 5, can be used as a star-delta, series parallel, or direct-current starter for single, two, or three-phase motors, and it gives protection against overload, interrupted service, and incorrect operation. The switch mechanism is of the drum controller type giving two breaks per pole. A no-volt release and manual trips are fitted at the end of the case, whilst overload coils or fuses are housed above the switch. A time lag device prevents the trip mechanism operating on momentary overloads.

The industrial type switch pillar shown in Fig. 6 embodies a 125-ampère oil circuit breaker for a 440-volt, 50-period, three-phase supply and is fitted with no-volt and overload releases. There is a bus-bar chamber, an interlocked isolating switch, and an ammeter. These circuit breakers are made in various sizes for use with motors up to 300 horse-power, and they are designed with a view to reducing the initial and maintenance costs. The switch mechanism is of the free handle type operating through a toggle and giving two breaks per pole under an ample head of oil. The rolling butt type self-cleaning contacts operate so that arcing can only take place at the tips and not on the contact surfaces. Provision is made on the case for mounting an ammeter, a voltmeter, or both. These circuit breakers are suitable for all kinds of industrial service and with bus-bar and isolating switches, also exhibited, they form convenient single-unit or multiple-unit ironclad switchboards. Moreover, in combination with a rotor starter they constitute an economical alternative to panel type switches with rotor starters for slip-ring motors. In each case the circuit breaker can be interlocked with the starter or with brush-lifting and short-circuiting gear. Among other things on the Metropolitan-Vickers Electrical Company's stand is the low-tension switchboard shown in Fig. 7. The board has been designed for the control of a house service generator, battery and feeder equipment.

### Wadkin and Co.

A considerable range of wood-working machinery is to be found on the stand of Wadkin and Co., of Leicester. Perhaps the most interesting machine shown by this firm is the semi-automatic wood miller which we illustrate in Fig. 8. This machine is designed for the production of patterns of all forms and for universal wood milling in general. A feature of it is the ease with which it may be re-set when changing over from one job to the next. The machine, as exhibited and illustrated, is direct driven by a 5 horse-power electric motor coupled to a three-speed gear box bolted to the side of the main column. This gear-box permits the cutter spindle to be driven at 1220, 2230 or 3940 r.p.m. The overhanging arm carrying the spindle head at its end is mounted to slide vertically on the main column and can be raised or lowered either by power or hand motion. In our engraving the attendant is shown operating the hand motion. An adjacent lever controls the power motion. The spindle head is arranged to swivel from the horizontal position shown in the engraving downwards and backwards through 180 deg. The principal angles for this swivelling motion are marked and a tapered spring plunger is provided to index the positions. Intermediate angles can be secured by a locking handle. Heavy ball bearings support and take the thrust of the spindle. The method of driving

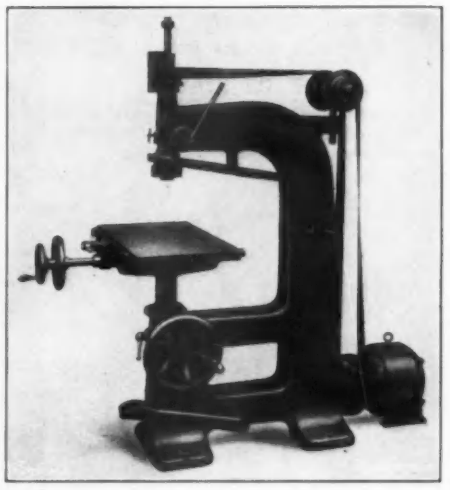
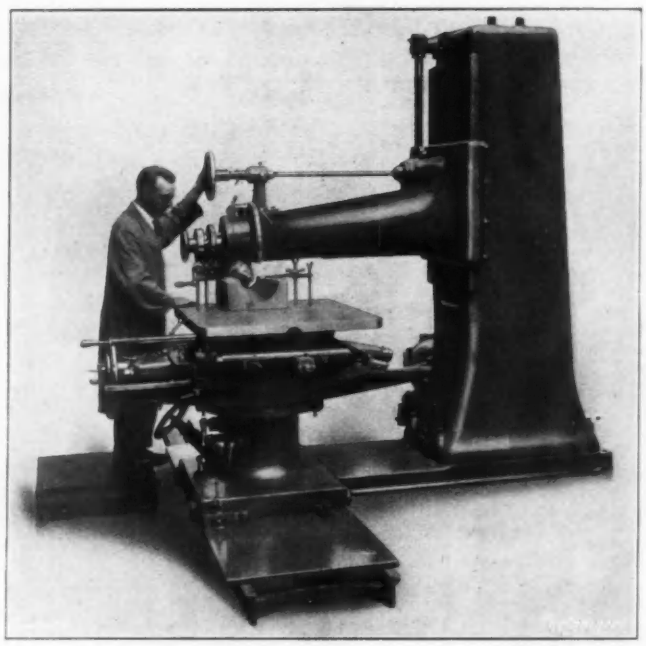
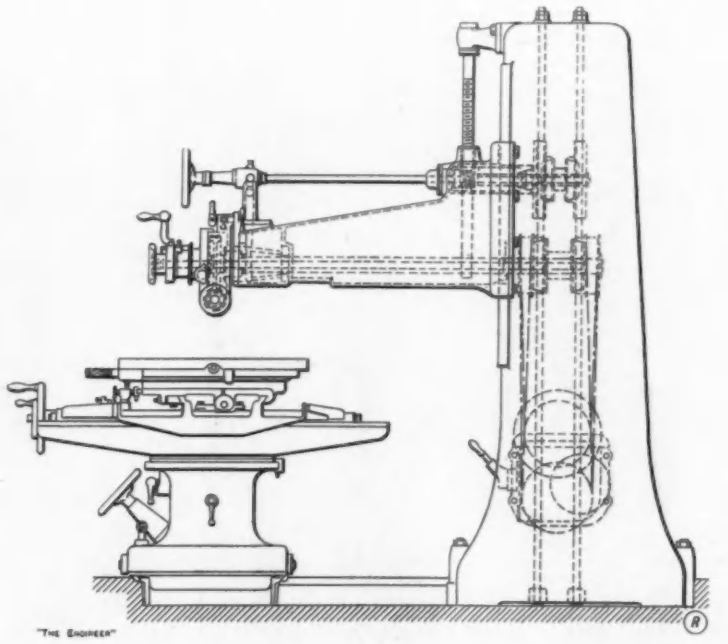


Fig. 10—Boring and Recessing Machine—Wadkin

the spindle is shown in Fig. 9. From a fast and a loose pulley on the gear-box shaft an endless laminated belt passes up the inside of the column to two pulleys, either of which may be engaged through a clutch with a horizontal shaft extending along the inside of the overhanging arm. From the end of this shaft the spindle is driven through spiral gear wheels, which are totally enclosed and run in grease. The spindle, it will be noticed, lies below the level of the arm and therefore is well situated to enter a core box with its axis parallel with the surface of the work without entailing the use of long boring bars. The starting, stopping and reversing of the cutter spindle are controlled from a hand wheel at the end of the overhanging arm, which hand wheel operates the two belt pulley clutches by means of a rod passing through the horizontal driving shaft. It will be observed that a similar arrangement of clutches and endless belt is used to give the power motion for the overhanging arm. The cutter spindle has a feed of 3in. within its housing, this feed being applied by means of a hand lever mounted at the end of the overhanging arm co-axially with the main control wheel. This feed is provided with a spring plunger and also with limit stops to define and limit the feed motion.

The work table is carried on a pedestal which can be moved by means of a hand wheel along a pair of






Figs. 8 and 9—Semi-Automatic Wood Milling Machine—Wadkin

rails, 24in. wide and 10ft. long, forming part of the base of the machine. A plunger and a locking handle are provided to locate the pedestal in the central position and to fix it in that or any other position. The top of the pedestal provides a seating on which the compound slides carrying the work table may be rotated. A plunger giving the principal angles and a locking bolt are provided for this motion. The ability to move the slides and work table into any angular position by means of this rotary adjustment is claimed to be very useful for certain operations and frequently to dispense with the necessity for resetting the work. Rotary movement of the work for feeding purposes is not obtained from this circular adjustment, but by rotating the work table relatively to the compound slides. This movement is obtained by turning a handle projecting from beneath the work table, which handle is also used to operate a plunger giving the principal angular positions of the table relatively to the compound slides. The compound slides are operated by two concentric hand wheels connected to screws. The nut engaging the cross motion screw is split and can be disengaged from the screw by means of a push and pull rod. When it is disengaged the table can be floated to and fro by hand on the ball bearings with which this motion is provided. It is claimed that the ability to move the table crosswise in this manner by hand is very useful when light work is being dealt with. Spring and dead stops are fitted to the slide motions of the table and

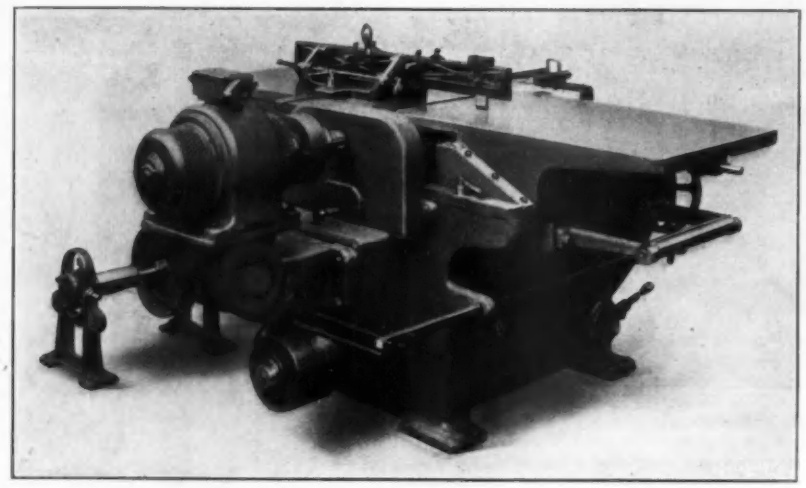


FIG. 11—SURFACING AND THICKNESSING MACHINE—WADKIN

standard and contraction scales are provided whereby the limits of the motions may be properly set.

Another machine on Messrs. Wadkin's stand, performing somewhat similar duties to those of the universal miller, but of a much lighter and simpler character, is the high-speed boring, recessing, and housing machine—illustrated in Fig. 10. The main frame of this machine is a one-piece casting. The cutter spindle slides in a sleeve having a two-stepped pulley on it, which is driven by belt, either at 2000 or 4000 r.p.m., by a 2 H.P. motor. The spindle can be moved vertically within the sleeve through a range of 4½in., either by a hand or a foot lever, whichever the nature of the work makes the more convenient. A stop is provided to regulate the downward movement of the spindle. The work table, measuring 30in. by 16in., is provided with a compound movement. Transversely the movement is 9in., and is obtained from a hand wheel and screw. Longitudinally, the movement is 25in., and is obtained from a rack and pinion motion. The table and its slides are carried on a vertical ram which can be raised or lowered through 6½in. by means of a hand wheel operating a self-locking worm wheel motion. For circular and radius work an auxiliary table, 18in. square, can be mounted to be rotated by hand about a central pin fixed to the main table.

A third machine exhibited by Messrs. Wadkin is the combined surfacing and thicknessing machine—illustrated in Fig. 11. This machine, as usual in one of its class, can be used to plane the surface of one side of a length of wood by passing the material forward over the cutter block and then to bring the material to the required thickness by passing it backwards beneath the cutter blocks. The upper or surfacing table visible in Fig. 11 is in two sections, which may be drawn apart sufficiently to permit the cutter block to be removed. Each part, in addition, may be raised or lowered through a range of ¼in. For some purposes, such as plain surfacing work, the two portions are set level, but for others, such as rebating, the front table is set down to give the desired depth of cut. In other cases, as, for instance, in the shaping of newels and other posts, in which the cut is required to begin and stop short some distance from the ends of the work, both portions of the surface table are set down relatively to the cutter circle. In addition to these movements, the front portion of the surface table may—as shown in Fig. 12—be tilted about a pivot at the rear side in order that the material may

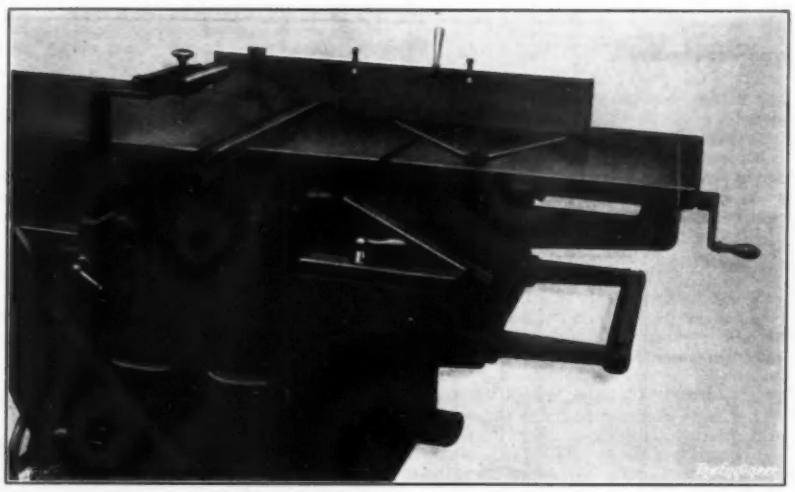


FIG. 12—WADKIN SURFACER SET FOR TAPER PLANING

be planed with a tapering thickness across its width The taper given by the tilt is indicated on a scale at the side of the table. This taper planing facility is intended particularly for the benefit of patternmakers, for it enables them to obtain their material from the machine with the correct "draught" required by the moulder.

The thicknessing table is not visible in Fig. 11, but its details are shown in the cross section given in Fig. 13. The table is raised or lowered to give the thickness required by means of a hand wheel at the front of the bed. This wheel drives, through a totally enclosed chain, a horizontal cross shaft, from which the motion is taken through enclosed spiral gear wheels to a pair of vertical screws supported on ball thrust washers and engaging with nuts beneath the table. The table is guided on broad slides on each side of the main frames and can be moved through a total range of 9in. A scale on the main frame and a pointer on the table indicate the thickness which the table is set to plane. Two adjustable anti-friction rollers are let into the surface of the thicknessing table, and at each end there is a carrier roller to support extra long work.

The cutter block is of the two-knife circular safety type, and complies with the new requirements of the Factory and Workshop Act with respect to non-mechanically fed overhand planing machines. If desired, it can be arranged that a portion of the cylindrical surface between the two knives shall be removable to permit of the attachment of a moulding cutter, so that moulding and surfacing may be carried out simultaneously. When the moulding iron is not required the flat surface on the cutter block is restored to the cylindrical form by the attachment to it of a making-up piece. A second iron may be attached on the opposite side of the cutter block in order to permit a piece of timber to be surfaced and simultaneously moulded along both edges or moulded on one and rebated on the other.

For surfacing on the upper table the feeding of the timber is performed by hand. For thicknessing on the under table, however, a power feed is supplied in the form of a grooved leading-in roller on one side of the cutter block and a plain leading-out roller on the other. These rollers are driven by an endless silent chain. The fence can be adjusted to tilt backwards through 45 deg. from the vertical position in order to permit the edges of the work to be bevelled. The fence is supported on the front surfacing table, and is attached thereto by means of a locking bolt and spigot engaging with a dovetail slot. This slot, as is to be seen in Fig. 11, is carried across an extension of the table projecting from one edge, the object being to permit the fence to be set back to an extent that will allow the full width of the cutters to be used without removing the fence from the table. In addition to the design of the cutter block, the

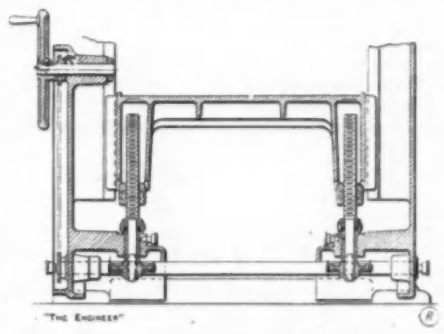


FIG. 13—PART SECTION OF WADKIN SURFACER

machine also complies with the requirements of recent additions to the Factory Act in the matter of a guard "capable of covering the full length and breadth of the cutting slot in the bench and so constructed as to be easily adjusted both in a vertical and horizontal direction." The guard provided is to be seen in Fig. 12 in the closed-up position. It is telescopic and can be pulled out until it touches the fence at whatever position the fence may be set. The guard is carried on an easily clamped arm, which is counterweighted to prevent the guard falling accidentally on the cutters.

The machine exhibited is capable of thicknessing timber up to 20in. wide by 9in. thick, and can surface timber up to 22in. wide. On the surfacing table it can take a cut up to ¾in. thick. The cutter block has a diameter of 5in. and runs at 4000 r.p.m. The power feed rollers have three rates of feed, namely, 14ft., 21ft. and 29ft. per minute. The machine is driven by a 5 horse-power motor.

### S. G. BROWN, LTD.

Among the exhibits on the stand of S. G. Brown, Ltd., North Acton, London, W. 3, we may, in the first place, direct attention to the range of electro-megaphones, of which an example is illustrated in Fig. 14, and of which the principle is shown in the diagram Fig. 15. The electro-megaphone is designed to take the place of the ordinary loud-speaking telephone for use in ships, trains, mines, factories, and in other places where verbal messages have to be transmitted in the midst of outside noises. The apparatus consists of a high-power differential microphone and a reed type of loud-speaking receiver, and does not make use of thermionic valves for the amplification of the transmitted speech. The amplification is stated to be sufficient to enable the captain of a ship standing on his bridge to issue orders to eight or more stations simultaneously.

By a simple arrangement of circuits it is possible to install the apparatus for two-way communication. The combined transmitter and receiver shown in Fig. 14 is intended for such two-way communication. The diagram Fig. 15 shows the connections for one-way communication. The differential microphone consists of a solid disc of carbon C attached by a rod to the apex of the conical transmitter diaphragm D and lying in a cell between two other carbon discs B $B^1$, the intervening spaces being packed with selected carbon granules. The discs B $B^1$ are connected to the primary windings P $P^1$ of two trans-

formers, the other ends of the two primaries being connected together. A battery or other source of electrical supply giving a pressure of about 12 volts is connected between the central disc C and the joined ends of the primaries. At one end the secondary windings of the transformers are connected together

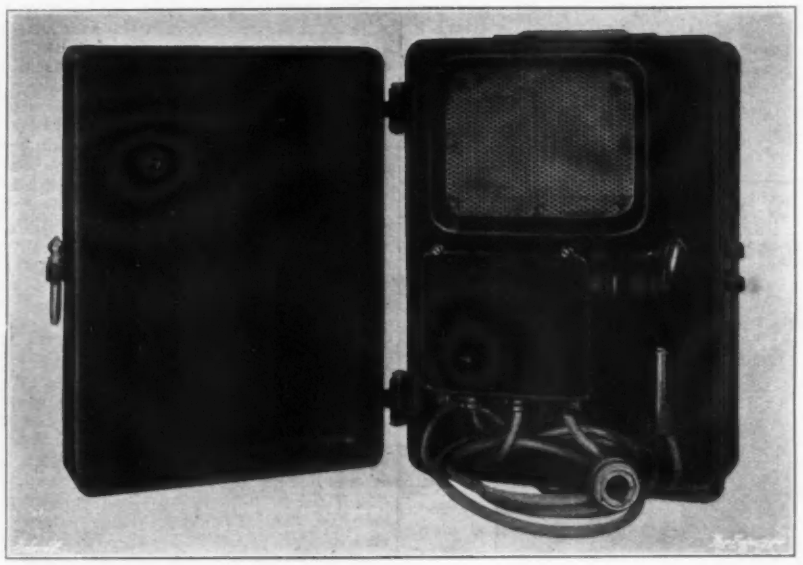


Fig. 14—Electro-Megaphone—S. G. Brown

and from the other leads are taken to the loud-speaking receiver.

If there is a movement of the centre disc C to the left the pressure on the granules between C and B will be increased, while that on the granules between C and $B^1$ will be diminished. The accompanying changes

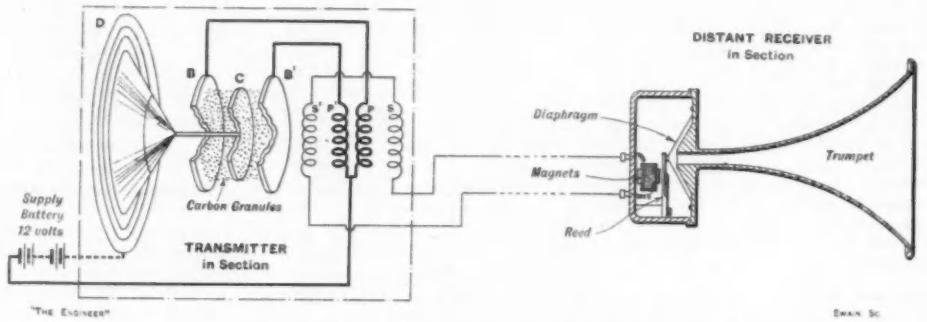



Fig. 15—Principle of Brown's Electro-Megaphone

of resistance will result in an increase in the current in the primary P and a decrease in that in the primary $P^1$. The two primaries are so arranged that the increase of current in P induces current in the secondary S in the same direction as the current induced in $S^1$ by the diminution of current in $P^1$.

Conversely a movement of the central disc C to the right produces a current in the opposite direction in the two secondaries. As a consequence, when the diaphragm D receives vocal sounds, its vibrations transmitted to the central disc produce an alternating current in the secondaries. This current flows through the small electro-magnets of the distant receiver, attracting and repelling the reed attached to a diaphragm beneath the trumpet.

An outstanding feature of the arrangement is the fact that a rapid fluctuation of the voltage in the supply lines—such as "commutator hum"—produces currents in the secondaries which are in opposition and which consequently neutralise each other. This result arises from the manner in which the primaries are arranged, as stated above, to induce in the secondaries currents in the same direction when the primary currents vary in opposite directions. If the primary currents vary in the same direction then the secondary currents must be opposed to one another. Another feature claimed for the arrangement lies in the form of damping to which the central carbon disc C is subjected. It is stated that the damping results in the elimination of all extraneous noises arising more than 2ft. or 3ft. away from the mouthpiece of the transmitter. The reed of the receiver is of the well-known Brown type and is tuned to vibrate naturally to speech frequencies. Its use ensures, it is claimed, the successful production of a great volume of speech. The normal operating pressure is 12 volts, but the apparatus can be worked directly from a 110-volt or 220-volt direct-current supply through series resistances without losses of any kind in the transmission.

The gyro-compass with all its outstanding advantages still suffers from the grave fact that it is much more expensive than the ordinary magnetic compass. Part at least of the additional expense is to be traced to the circumstance that in order to eliminate or reduce the effect of rolling and pitching on the compass readings it is customary to employ a master compass situated somewhere near the centre of gravity of the vessel and to employ a somewhat involved system to relay the indications of the master compass to a repeater compass on the bridge. With the intention of cheapening the cost of installing a gyro-compass by the abolition of the repeater and its connected gear, Mr. S. G. Brown has introduced the steering gyro-compass which, as exhibited at the Fair, is illustrated in Fig. 16. This compass is so designed from the gyroscopic point of view that it is not necessary to place it at or near the centre of gravity of the ship. It can, in fact, and is primarily intended to be situated directly beside the helmsman on the bridge in the position occupied by the repeater compass in the ordinary equipment. The only other adjuncts required are a switchboard, a motor generator and an emergency battery for use in the event of the ship's supply failing. These three adjuncts may, like the compass itself, be placed on the bridge with, as a consequence, a considerable saving in the amount of wiring required and of time expended in installing the equipment. Into the gyroscopic features of the compass and the modifications of them imposed by the transference of the compass from the centre of gravity of the ship to a point well above it, the present occasion does not afford us a suitable opportunity to go. The transference makes it necessary to provide additional protection to the compass in order to adapt it to the increased exposure of its new station. To that end, it will be observed, the compass card is not directly exposed to the helmsman's vision. The whole compass is boxed in and an image of the edge of the card is reflected in such a way as to be visible through a hooded aperture at the end of a projecting horizontal

Fig. 16—Steering Gyro-Compass—S. G. Brown

arm. The portion of the card seen through the aperture is illuminated by means of a lamp deriving its supply from the mains supplying the compass motor, so that failure of the current in the mains is brought immediately to the attention of the helmsman by failure of the illumination of the aperture. The position of the arm and its aperture can be adjusted to give the best possible view of the readings to the helmsman without in any way interfering with the action of the compass. The cover of the compass, while not intended to withstand total immersion, is claimed to be proof against rain, spray, and dampness.

### George Ellison.

Among other new switchgear exhibited by George Ellison, of Perry Barr, Birmingham, is an 11,000-volt oil circuit breaker mounted in a truck switchgear unit—as shown in Fig. 17. Above the oil tank of the circuit breaker—see Fig. 18—there is a gas chamber with a vent for the purpose of discharging any gas that may be present inside the cell. The bottom of the gas chamber is dished, so that it dips into the oil tank, which is completely filled with oil, thus avoiding an air cushion above the oil. Gases formed when the circuit is broken are discharged into the upper chamber, which does not contain any live metal. The truck unit is composed of steel, and a special

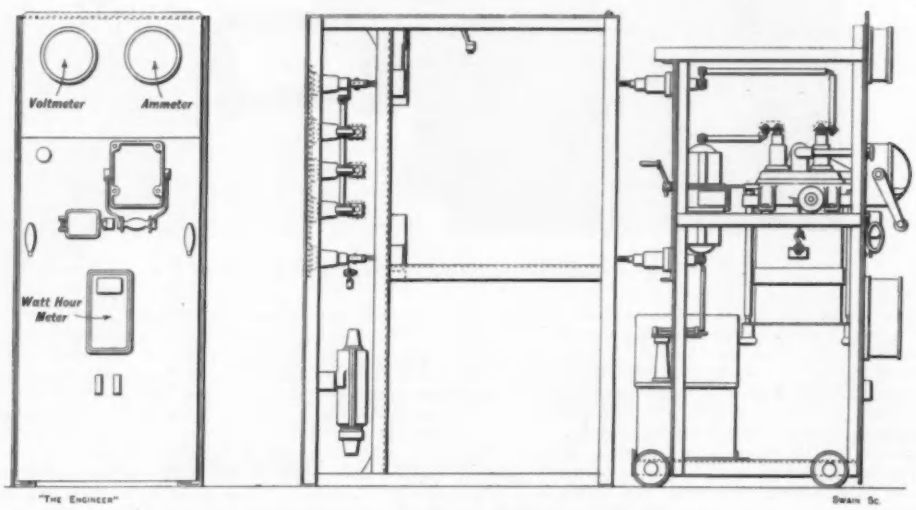



Fig. 17—11,000-Volt Oil Circuit Breaker—Ellison

feature, apart from the circuit breaker, is that flexible self-aligning contacts are provided for connecting the truck to the bus-bars. All live metal connections and bus-bars are entirely covered with insulating material, and the clearances are in accordance with British

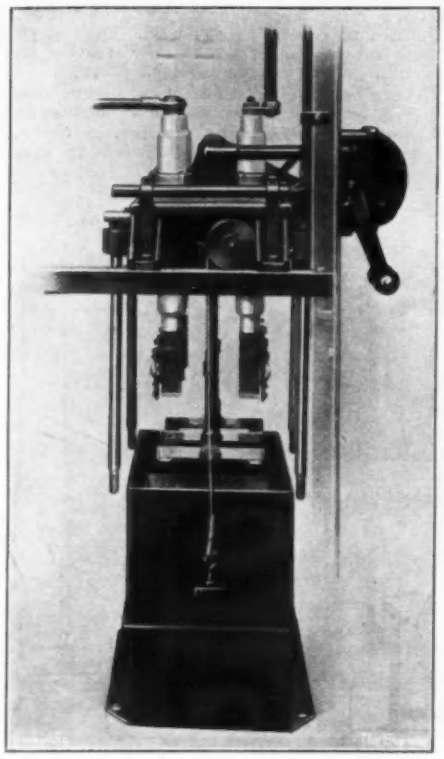


FIG. 18—OIL CIRCUIT BREAKER—ELLISON

Standard Specification 116/23. Hence even if the covering is accidentally or wilfully removed, the liberal spacings of the conductors still afford considerable security. Interlocking arrangements ensure complete safety during operation and maintenance.

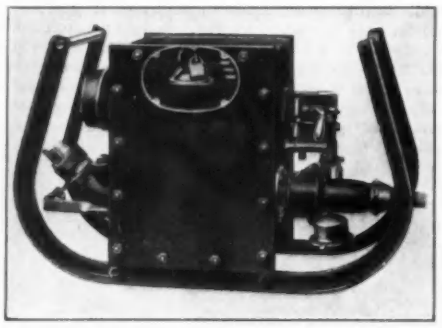


FIG. 19—MINING CIRCUIT BREAKER—ELLISON

All the usual automatic releases and instruments may be fitted. The welded steel cased mining circuit breaker—shown in Fig. 19—is for use at gate ends in mines. It is constructed on exceptionally strong lines, and is carried on a skid cradle frame. The gas

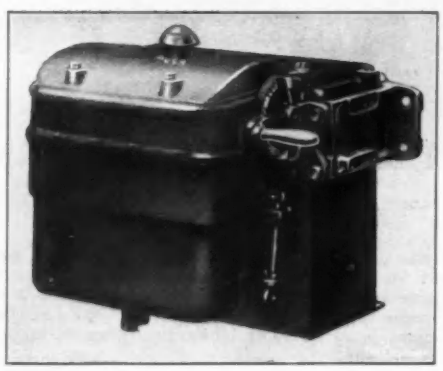


FIG. 20—AUTO-TRANSFORMER STARTER—ELLISON

vent consists of a pile of baffle plates fitted in a ventilating attachment. The circuit-breaker is of the magnetic blow-out air-break type, and its handle is interlocked with the trailing cable plug. The construction is lighter than that of a circuit-breaker with a cast iron case, and consequently it is more easily moved from place to place.

The firm's new auto-transformer starter—shown in Fig. 20—is designed for motors up to 20 horse-power, and comprises an oil-break change-over switch with circuit-breaker type overload and no-volt releases, and a correct sequence device mounted on the front of a steel tank containing an oil-immersed transformer. The terminals of the transformer are very accessible, and they are provided with detachable links for connecting to a set of three alternative tappings. The starter is very suitable for wall mounting, but stands may also be used for floor mounting. A part of the firm's stand is devoted to "Tufnol" insulating material, which is a tough horn-like reinforced synthetic resin baked under pressure in moulds. For enclosing apertures and covering connections a plastic insulating synthetic resin material is shown.

### THE DRAYTON REGULATOR AND INSTRUMENT COMPANY, LTD.

On the stand of the Drayton Regulator and Instrument Company, Ltd., of West Drayton, Middlesex, various forms of temperature and pressure regulators and recorders and other apparatus are shown. The principle of the Drayton temperature regulator is indicated in the diagram—Fig. 21—in which it is shown applied to a vessel, the contents of which are heated by means of steam. Inside the vessel there is a thermostatic tube A filled with a volatile liquid or inert gas, the pressure of which varies with the temperature. This tube is connected to an external capsule diaphragm B which responds to changes in pressure. The movement of the diaphragm is transmitted through a lever C to a lever D, which at its end carries a disc E arranged adjacent to an orifice F. As the temperature inside the heating vessel increases the pressure inside the capsule B rises and the disc E approaches the orifice F. A fall in the temperature causes the disc to move away from the orifice. Compressed air admitted at G escapes as a consequence through the orifice F to a lesser or greater extent,

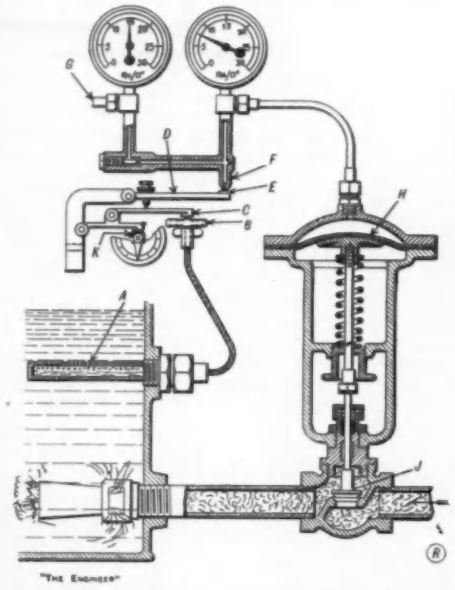



FIG. 21—TEMPERATURE REGULATOR—DRAYTON

according as the temperature rises or falls, and as the escape decreases or increases, the air pressure above the diaphragm H rises or falls. The pressure on this diaphragm acts upon the spindle of the steam valve J against the force of a spring. The final result is therefore that as the temperature inside the heating vessel rises the steam supply is reduced, and as it falls the steam supply is increased. The point of balance is reached when the steam valve is just sufficiently open to admit enough steam to compensate for the heat losses or absorption without causing a rise of temperature. The exact temperature at which the point of balance occurs is controlled by the setting of the cam K, which, when it is turned, raises or lowers the fulcrum of the lever C and therefore causes the disc E to approach or recede from the orifice F. The regulator can be arranged to control a cooling medium by causing a rise of temperature to effect the opening of the orifice and a fall to close it. The same principle is employed in regulators for the control of humidity, pressure, vacuum and liquid level.

Of the special applications of the regulator shown at the Fair, we may deal with two forms, namely, the time temperature regulator and the automatic humidity regulator. The time temperature regulator is illustrated in Fig. 22. The main details are similar to those already described, but it will be noted that the capsule B, mounted at the end of a flexible tube, is supported on a lever L, against the tail of which the cam K acts. The lever C is fulcrumed at M and is in two parts, which are hinged together at Q. The right-hand part acts, through a set screw, on the tail of the lever D. The end of the left-hand part carries a rider N which bears against a cam driven in the anti-clockwise direction by clockwork. This cam may be described as consisting of a circular disc, of which a 90 deg. sector is cut down on the face to accommodate a spring P. One end of this spring is fixed to the periphery of the disc, while the other is held in a clamp which can be set to give the spring a varying degree of curvature. The spring in this way forms a variable portion of the cam profile.

With the apparatus set at the outset as shown, the steam will cause the temperature of the heating vessel to rise, and consequently if nothing else happened the expansion of the capsule B would result in the closing of the steam valve. The expansion of the capsule is, however, counteracted by the movement of the rider over the spring portion of the cam. That

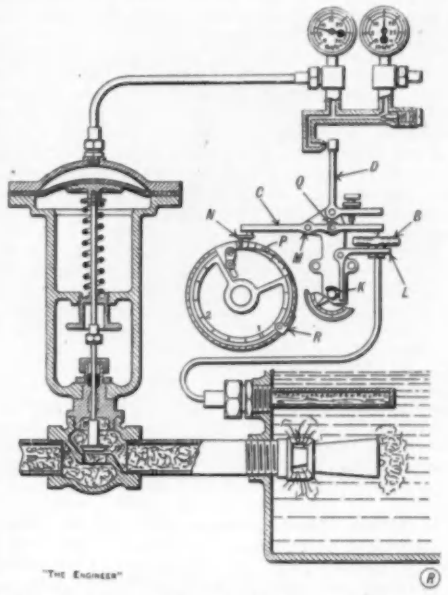



FIG. 22—TIME-TEMPERATURE REGULATOR—DRAYTON

movement depresses the hinge point Q and therefore checks the closing of the orifice by the lever D in the normal way. As a consequence, the temperature of the heating vessel instead of remaining constant rises progressively until the rider leaves the spring and passes on to the circular portion of the cam periphery. Thereafter, the apparatus behaves normally and preserves the temperature at the point reached when the rider passes off the spring. The temperature is maintained at this constant value until the rider is knocked off the cam by a tripping piece R. The period of time during which the temperature is allowed to rise is set by adjusting the curvature of the spring P. To facilitate this adjustment, the

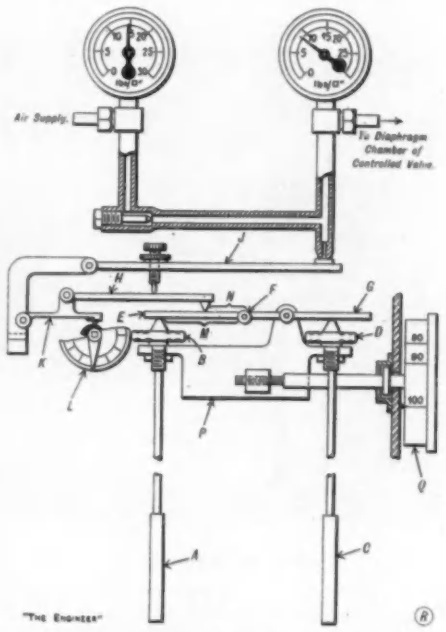



FIG. 23—HUMIDITY REGULATOR—DRAYTON

cut-away portion of the cam face is marked in five-minute graduations up to ¾ hour. The period during which the temperature is maintained constant is determined by the position of the trip R, which is set against a scale extending round the remainder of the cam. The temperature attained at the end of the rising period is controlled by the cam K, and can be adjusted while the apparatus is in action. When the rider is knocked off the cam by the trip, the lever D completely closes the leak through the orifice and the steam valve is shut down.

By means of suitably designed cams, any desired cycle of temperature variation can be secured by the

arrangement. In the form illustrated in Fig. 22 it is applicable to the control of the temperature of dye-vats and for similar purposes. In an application of this regulator specially designed for use in conjunction with rubber vulcanisers, two separate thermostatic systems are arranged to operate in conjunction with one clock-driven cam. One of the systems controls the inlet of steam to the vulcaniser, while the other, set to operate at a slightly lower temperature, controls the outlet valve for the water of condensation. By means of the two systems, the prompt removal of any condensation is effected at all stages of the heating cycle. When the rider is knocked off the cam at the end of the holding period a blow-off valve is operated to empty the vulcaniser of steam and at the same time an electric bell is rung to signal that the operation is finished.

The automatic humidity regulator is illustrated in Fig. 23. The regulator makes use of a leaking orifice in the manner characteristic of the Drayton system. Its operation is based on the fact that under conditions of constant relative humidity, a rise in the dry bulb temperature is accompanied by a proportional rise in the wet bulb temperature. The proportionality is constant for any given percentage of relative humidity but varies with different humidity percentages.

In the diagram A B is the wet bulb and C D the dry bulb thermostatic system. The wet bulb A is mounted over a water box fitted with a float valve for maintaining the water level constant, and with a motor-driven fan which sucks air continuously over the wet bulb. The wet bulb capsule B acts upon a lever E which is pivoted at F to a lever G, on which the dry bulb capsule D acts. The movement of the lever E derived from the expansion or collapse of either capsule is transmitted to the lever H and thence through a set screw to the lever J at the end of which the orifice disc is mounted. The lever H is fulcrumed to a lever K, the elevation of one end of which is governed by the cam of the hand-setting device L.

If the wet bulb temperature rises, the leak through the orifice will be reduced and the pilot valve will be moved towards the closed position. Consequently, a constant wet bulb temperature will be maintained at a constant dry bulb temperature.

If the dry bulb temperature rises, without an equivalent rise in the wet bulb temperature, the leak through the orifice will be increased and the pilot valve will open. As a result, there will be a rise in the humidity and a consequent rise in the wet bulb temperature, which will react on the wet bulb A and produce a tendency for the pilot valve to close.

The degree to which the wet bulb temperature must rise following a rise in the dry bulb temperature in order to maintain a constant percentage of humidity is determined from humidity tables, and is governed by the ratio of the lengths M to N on the lever E. The ratio of these two lengths is adjustable to suit different percentage humidities. This adjustment is effected by moving the sliding bracket P through the agency of a screw carrying a calibrated setting head Q. After the ratio adjustment has been made, the correct valve opening to give the requisite amount of moisture is realised by operating the hand-setting system L.

This regulator is claimed to be particularly useful for conditioning air in industrial processes, which involve either the abstraction of moisture from the air or the addition of moisture to it.

### The National Gas Engine Company, Ltd.

The most novel exhibit on the stand of the National Gas Engine Company, Ltd., of Ashton-under-Lyne, is undoubtedly the 10 B.H.P. National-Michell crankless gas engine, which has been built under licence from Crankless Engines, Ltd., of London. A section through the engine is reproduced in Fig. 24, and in Fig. 25 we give a view of the complete engine and its direct coupled, 6·9-kW, 230-volt generator, which was supplied by Electromotors, Ltd., of Openshaw, Manchester.

The engine has three cylinders, and gives an output of 10 B.H.P. at 1200 r.p.m. when running on town's gas. The four-stroke cycle of operation is employed, and the valves, which are of the poppet type, are driven by a single face plate cam worked from the main shaft through epicyclic gearing. Battery ignition is fitted, with a high-tension coil and a distributor which is mounted on the top of the engine with the leads carried to the end connections through a length of tubing. A small gear pump supplies oil under pressure to all the bearings.

From the section reproduced in Fig. 24 it will be gathered that the three cylinders are arranged around the main shaft and parallel to it, the thrust from the pistons being transmitted to the slant mounted on the main shaft, through Michell thrust washers with spherical seats. The proportioning of the slippers according to Mr. Michell's ideas and patents allows high surface speeds to be used on the slant with the minimum of frictional loss. It may be noted from the section we reproduce that a flexible coupling is embodied in the fly-wheel. As shown in Fig. 25, the cylinder liners are water-cooled and the water is discharged to an open tundish at the front of the engine. Windows are provided so that the slant may be seen and to the right of the inspection window is the starting and barring handle.

The largest oil engine on the National Gas Engine Company's stand is the twin-cylinder unit which we illustrate in Fig. 27. It is designed for an output of 100 B.H.P. at 230 r.p.m., and each of the two cylinders has a bore of 13in. with a stroke of 20in. There is a common bed-plate for the two cylinders, to which the cylinder jackets are bolted, and a single crank shaft is fitted with a large fly-wheel on the outside of the bed-plate. In the foreground of our illustration there will be seen the side shaft, with the drive for the mechanically operated lubricator, and the air-starting, half-compression, air inlet and exhaust cams. Air is taken in through a filter on the inside of the cylinder head to the upper air inlet valve. The exhaust valve is below the inlet valve. On the exhaust pipe is a fuel heater, with a gauze and silk filter, through which all fuel oil is made to pass on its way to the fuel pump and atomiser. The amount of fuel oil delivered to the atomiser is varied by the centrifugal governor, which acts directly on the fuel pump. In the illustration, two governors are shown, but one governor working a long track rod connecting both fuel pump controls is also used. The fuel pump plunger and the control gear are easy of access, and a pump priming and starting handle is provided.

The engine exhibited is one of the middle sizes of twin-cylinder units in a range of nine single-cylinder and seven double-cylinder engines, with rated outputs from 18 to 200 B.H.P. maximum output.

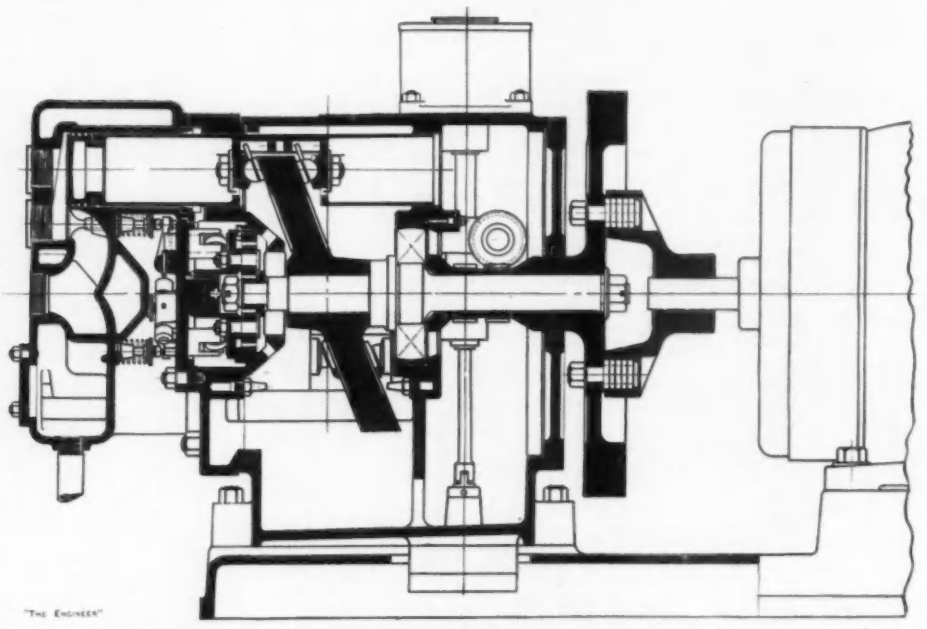


Fig. 24—Section of 10 B.H.P. National-Michell Crankless Gas Engine

A gas engine with a designed output of 13½ B.H.P. on town's gas and 10½ B.H.P. on producer gas is also shown. Among the smaller engines there is exhibited a four-stroke, horizontal, hopper type engine, which can be supplied for running on petrol and paraffin fuel or on town's gas. It has a rated horse-power of 2½ to 3 B.H.P. at speeds of 800 to 1000 r.p.m. Care has been taken to give a maximum degree of access to all working parts, and an improved system of electric ignition is fitted. Although hopper cooling is fitted to the engine exhibited it can equally well be arranged for syphonic cooling if so desired. This engine is particularly designed for agricultural work and for small house lighting plants. Another oil engine is one of the firm's well-known chain-driven dynamo type, with an output of 10 B.H.P., which is generally started by an ignition tube heated up by a special lamp.

We illustrate in Fig. 26 a portable type of National petrol-paraffin engine with an output of 5½ B.H.P. at 1000 r.p.m., which is coupled direct to a "Wallwin" non-chokeable pump with a "Wheeler" type impeller. This pump is specially designed to deal with liquids containing lumpy, fibrous or solid matter, and to pump any such material which can pass through the suction and delivery pipes. These pumps are made in 2in., 3in., 4in. and 5in. sizes, capable of dealing with quantities of from 100 to 400 gallons per minute. The particular pump on view is the 3in.

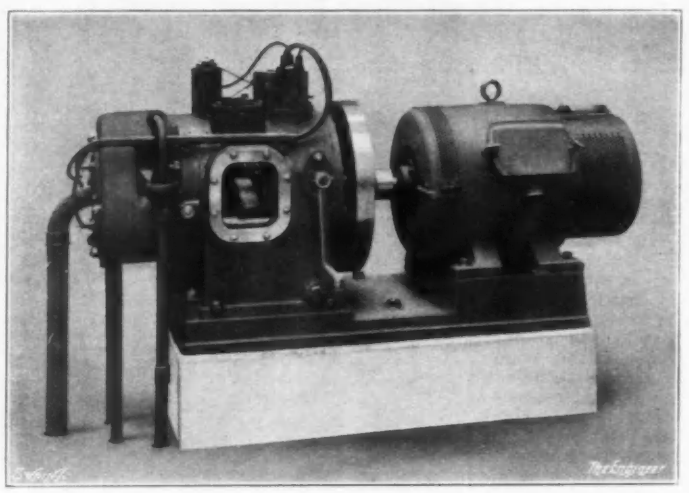


Fig. 25—Crankless Gas Engine—National

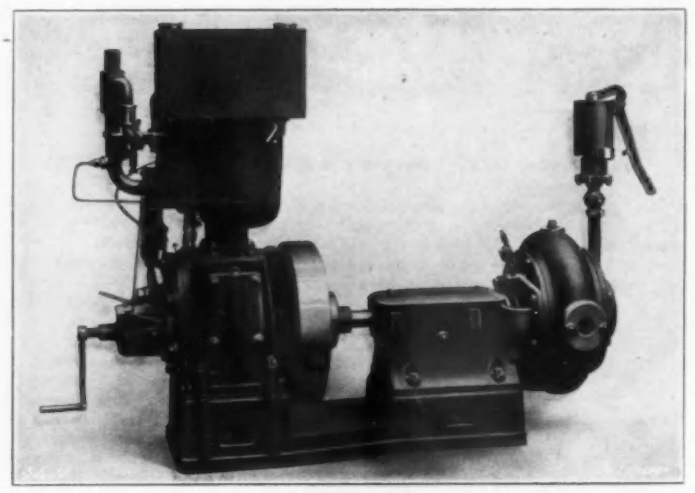


Fig. 26—Portable Engine and Pump—National

size, which has a designed output of 200 gallons of water per minute, delivered against a head of 30ft. A standard 1000-gallon per hour belt-driven ram pump is also exhibited.

Finally, we may briefly refer to a small petrol engine-driven air compressor set, which is supplied for starting the larger engines. It comprises a belt-driven air compressor and a small two-cycle petrol engine with its fuel tank and control pillar all mounted on a common base plate. The particular oil engine starting set shown has a designed output of 3¼ cubic

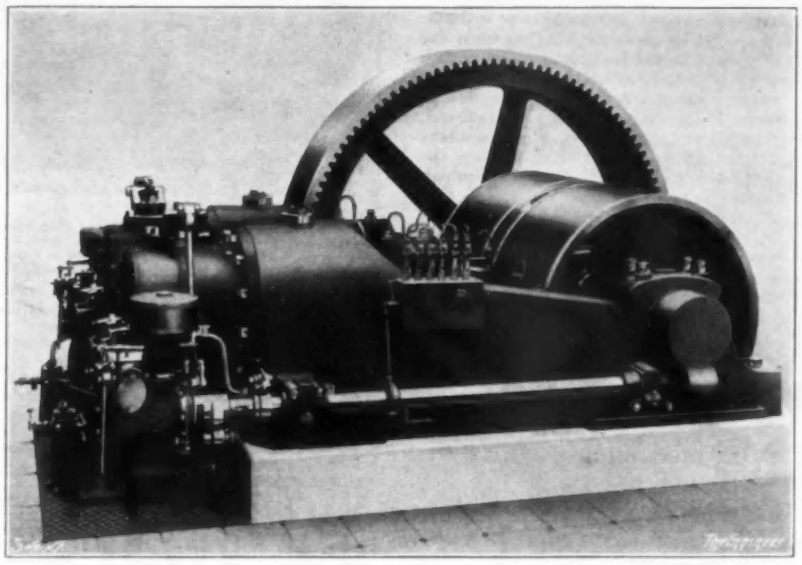


FIG. 27—100 B.H.P. TWIN-CYLINDER OIL ENGINE—NATIONAL

feet of free air per minute, delivered at a pressure of 250 lb. per square inch. Fast and loose belt pulleys are provided, so that the compressor can be belt-driven from the main engine crank shaft for normal service. This being so, the petrol engine will only be needed in cases of emergency. For gas engines a compressor with an output of 7¾ cubic feet of free air per minute is built to give delivery pressures of 100 lb. to 120 lb. per square inch.

NORRIS, HENTY AND GARDNERS, LTD.

A comprehensive display of oil engines is to be found on the stand of Norris, Henty and Gardners,

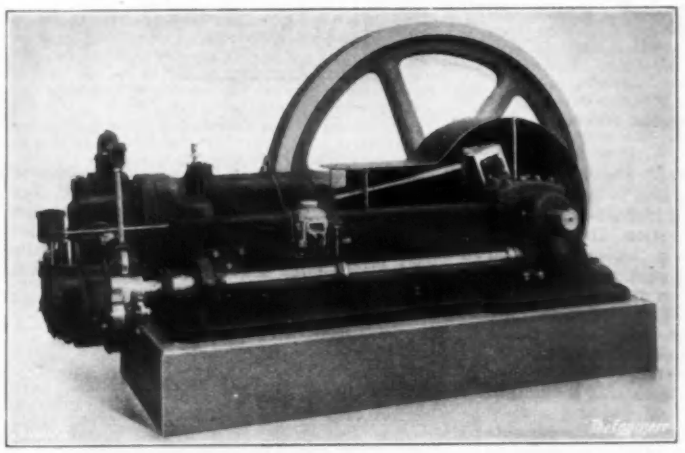


FIG. 28—65-69 B.H.P. COLD-STARTING OIL ENGINE—NORRIS, HENTY

Ltd., of London and Patricroft. Fig. 28 shows the larger of two engines of the horizontal, cold-starting, four-stroke type, which is designed for an output of from 65 to 69 B.H.P. at a normal speed of 220 r.p.m. The cylinder has a bore of 13½in., with a stroke of 22in., and is one of the larger units in a range of nine single-cylinder and five double-cylinder cross-coupled engines, embracing outputs from 17 to 224 B.H.P., and with cylinder bores from 7½in. to 16½in. Below these sizes there are three smaller units, of which the smallest, a 7 B.H.P. engine, is displayed on the stand. As our engraving shows, the heavy girder type bed-plate is formed in one with the cylinder jacket. The liner is a separate casting, and is pressed into the jacket from the breech end. It is held in position by the cylinder head bolts. A patented type of combustion chamber is employed, which is completely water-cooled and which is circular in form, with the throat opening to the cylinder tangential to the combustion chamber. The fuel spray nozzle is also placed tangentially to the circular combustion space. The entering fuel is in this way given a whirling motion, and an amount of ordered turbulence is created, which assists complete combustion. On the opposite side of the head to the fuel spray there is a combined relief valve, starting valve, and air charging valve, while on the top side of the chamber there is arranged the air inlet valve and immediately below it the exhaust valve. The exhaust valve is worked by pivoted lever, and the air inlet valve by an inclined push-rod from cams on the lay shaft.

The fuel pump and governor valve are neatly grouped together in an enclosed casing at the breech end of the engine. The time of ignition is constant and the amount of fuel delivered is varied by the governor. The governor is driven from the lay shaft through an elastic spring coupling, the function of which is to eliminate any torsional variation in the drive when the cams are engaging the valve levers, thereby ensuring a steady drive. The cylinder and piston, and the connecting-rod ends are supplied with oil from a mechanically operated multi-point lubricator, as shown in the engraving, and it may be noted that, as well as the excentric, a hand-operating crank is provided for flushing the parts with oil before starting. As we have already remarked, the larger engines are cross coupled, with a continuous crank shaft for the two cylinders and a common fly-wheel.

For all except the smallest engines, which are hand started, a compressed air bottle is provided, and is charged with air from the cylinder through the charging and starting valve on the cylinder head. In the case of the larger engines an air-charging compressor set similar to that illustrated in Fig. 30 is recommended. This unit comprises a small 1¼ H.P. Gardner petrol motor, running at 770 r.p.m., to which is attached an obliquely arranged air compressor cylinder, driven from the same crank shaft. The air enters the cylinder through ports controlled by the piston, and there is only one valve, namely, the delivery valve. As both the engine and compressor are water jacketed, the set may be used for pressures up to 300 lb. per square inch. A four cubic foot air receiver can, we understand, be charged up from 0 lb. to 250 lb. per square inch in a little over 20 min. The unit we illustrate forms also a very useful stand-by set for cold-starting oil engine installations.

The engines we have described have, we are informed, fuel consumptions of round about 0·40 lb. per B.H.P. hour.

Another type of engine manufactured by Messrs. Gardners is represented by the four-cylinder, petrol-paraffin unit designed for an output of 20 B.H.P. at 1000 r.p.m., which drives by belt a dynamo for lighting the stand. In this series of engines there are nine sizes, embracing two, three, and four-cylinder units, with outputs from 10 to 48 B.H.P. on petrol and 9 to 38 B.H.P. on paraffin fuel. They are also supplied with a marine type crank case for lifeboat work and the propulsion of small pleasure craft.

Another interesting exhibit is the four-cylinder vertical two-stroke motor illustrated in Fig. 29. This engine is one of the smaller sizes in a series of three,

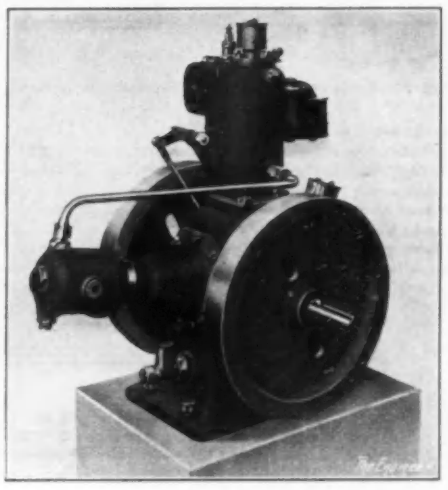


FIG. 30—AIR COMPRESSOR—NORRIS, HENTY

four, and six-cylinder units, embracing outputs from 36 to 300 B.H.P. The engine we illustrate has cylinders 7in. in bore, with a stroke of 8in. and is designed to give 48 B.H.P. at 450 r.p.m. It is provided with a standard clutch, is direct reversing, and on each cylinder is fitted with the firm's patented electric igniter plug, in combination with a rotatable fuel spray, as indicated in Fig. 31. The igniter element consists of a coil of fine high resistance wire embedded in a plug of refractory material. Current is supplied by a direct-driven dynamo at a pressure of 12 volts, and is sufficient to heat the coil to redness. The drawing we reproduce shows two positions of the fuel spray. When the sprayer handle is moved to the right, so that it rests on the stud of the clamping plate, the

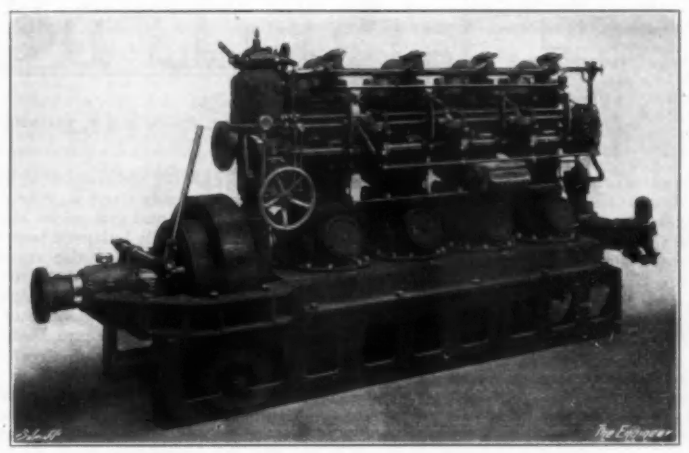


FIG. 29—48 B.H.P. TWO-CYCLE OIL ENGINE—NORRIS, HENTY

spray is directed on to the heated coils of the plug, so that ignition can immediately take place. When

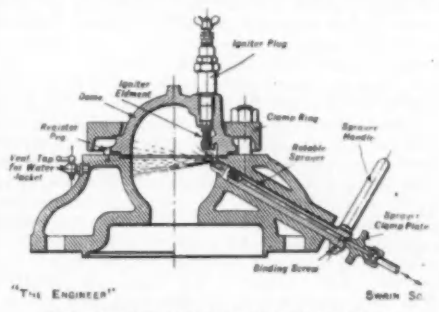



FIG. 31—FUEL SPRAY—NORRIS, HENTY

the engine has been run up on load, a turn of the sprayer handle to the left, so that it rests on the opposite stud, deflects the spray over to the far side

wall of the combustion chamber dome. On each cylinder there is a switch made of fibre with laminated copper contacts, to cut off the current from the igniter plug. The rotatable spray, it is claimed, also pro-

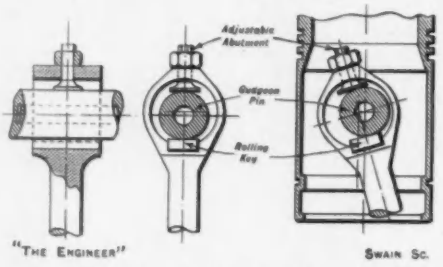



FIG. 32—CONNECTING ROD END—NORRIS, HENTY

vides a means of running efficiently at very light loads.

A further point of interest in this type of engine is the provision of a roller bearing in the small end of the connecting-rod. The design—shown in Fig. 32—is similar to that used in the Kromhout engine, and is made under licence.

There are three parts to the bearing, a lower key upon which the gudgeon pin rolls in line contact, the pin itself, and an adjustable abutment which positions the pin when the piston is being taken out, but which does not touch it in actual service. When the engine begins to turn, the rod positions itself automatically, and the key rolls to and fro through an equal distance on each side of the centre line of the rod. The makers claim that with this type of top end bearing the pin can be worked in four positions before it requires renewal.

The clutch, which is of the expanding drum type, is mounted along with the ball thrust bearing on a detachable sole-plate, one clutch member being directly bolted to the fly-wheel. The arrangement is shown to the left hand of Fig. 29, which also illustrates the reversing mechanism, and the reversing hand wheel. The complete operation of reversing is performed by four turns of the wheel. On the first turn of the wheel the fuel pumps are cut out and the engine comes to rest. By continued rotation the angular position of the cam shaft is altered from "ahead" to "astern," or *vice versâ*, and the fuel pumps again come into action, along with the compressed air for starting. Finally, the air is cut off and all cylinders are put on to fuel. The complete operation takes from three to four seconds. A neat device is an automatic ahead-astern indicator, which works by the drag of the lubricating oil on one of the shafts and shows which way the engine is running. At the right-hand end of the engine are arranged the plunger-type bilge and circulating pumps, which are driven direct from the crank shaft. Engines of the type we have described are supplied for auxiliary uses aboard ship, and for the propulsion of barges, tugs and cargo boats. An interesting example of the latter type of installation is that on the Denny-built motor car ferry "Fishbourne," which was described in THE ENGINEER of July 22 last year, and which is employed by the Southern Railway for service between the mainland and the Isle of Wight. It is propelled by two four-cylinder Gardner engines of the type we have described, each of which is designed for an output of 120 B.H.P. at 340 r.p.m. So successful has been this boat that a similar vessel has recently been ordered from Messrs. Denny, in which Gardner engines will also be fitted.

THE HEATLY-GRESHAM ENGINEERING COMPANY, LTD.

Some interesting examples of small power oil engines are to be seen on the stand of the Heatly-Gresham Engineering Company, Ltd., of Letchworth. We show in Fig. 33 a section through a four-cylinder "Rational" marine oil engine of the firm's latest design. The designed output is 16 B.H.P. at 1200 r.p.m., and each of the cylinders has a bore of 3½in., with a stroke of 4½in. As our drawing shows, the cylinders are cast in pairs and detachable cylinder heads are provided. The pressure joint between the head and the cylinder jacket casting is made with a copper and asbestos gasket, in which, in the way of the cooling water passages, large holes are left to take cork washers. As sea water cooling is employed, it is claimed by the designers that the cork washers effectually prevent any galvanic action between the copper of the gasket and the iron castings which might lead to local corrosion being set up.

From Fig. 35 it will be seen that the crank case of the engine is furnished with two large inspection doors. These doors enable bearing adjustments to be made, and at the same time allow the piston and connecting-rods to be withdrawn through them. The same parts can also be removed in an upward direction by taking off the detachable cylinder heads. The crank shaft is made from high-tensile steel, and is machined all over and ground on the pins and journals. It is also carefully balanced to prevent vibration. Drop forgings are used for the connecting-rods, which are fitted with bronze top-end bushes and with white metalled big end bearings. Light cast iron pistons with three compression rings and a floating gudgeon pin are fitted. The cam shaft is driven by chain from the crank shaft, which works in an oil-tight casing. By means of this silent drive and the amply proportioned valve tappets and cams, quiet running, it is claimed, is assured.

The lubricating system is automatic, and represents a departure from usual practice. Oil is delivered to the top cam shaft bearings by a valveless oscillating pump operated from an excentric on the crank shaft. From the top cam shaft bearings, it overflows and finds its way to dipper troughs beneath the connecting-rods. By means of the dippers attached to the ends of the connecting-rods, the oil is carried up to sloping oil ducts, which feed the main bearings. The makers claim that the system is fully automatic, and that it is unaffected by the pitching or rolling of the vessel in which the engine is installed.

It will be noted from Fig. 33 that the inlet and exhaust manifolds are both cast together, so that a hot inlet with improved vaporisation is obtained. A high-tension magneto with an impulse starting attachment serves for ignition purposes. The sparking plugs are placed centrally in the cylinders. A water pump of the gear type is provided, and is directly driven from the end of the crank shaft. At the after end in Fig. 33, the raised hand starting gear may be noted, while provision is also made for a chain-driven dynamo-motor for power starting, which is placed at the forward end of the set.

In addition to the set we have described, the firm is showing a small lighting equipment, with a generator by Newtons, Ltd., of Taunton. This new design of engine can with a slight modification be run on town's gas, while either petrol, paraffin, benzole or alcohol fuel can also be used with appropriate carburettors.

In Fig. 34 we show one of a complete range of

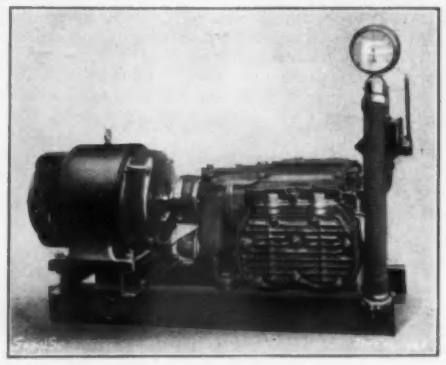


FIG. 34—EXHAUSTER SET—HEATLY-GRESHAM

vacuum exhausters which the firm is exhibiting, and which it supplies to railway companies, both at home and abroad. The example illustrated is a machine with a designed capacity of 120 cubic feet per minute, which on the stand is driven by a 5 B.H.P. Bruce Peebles motor. In designing these exhausters, the object has been to produce a machine that will run silently and trustworthily over long periods without attention. A similar machine to that illustrated has been run, we are informed, for over 750 hours continuously without any attention being given to it, or without replenishing the supply of lubricating oil.

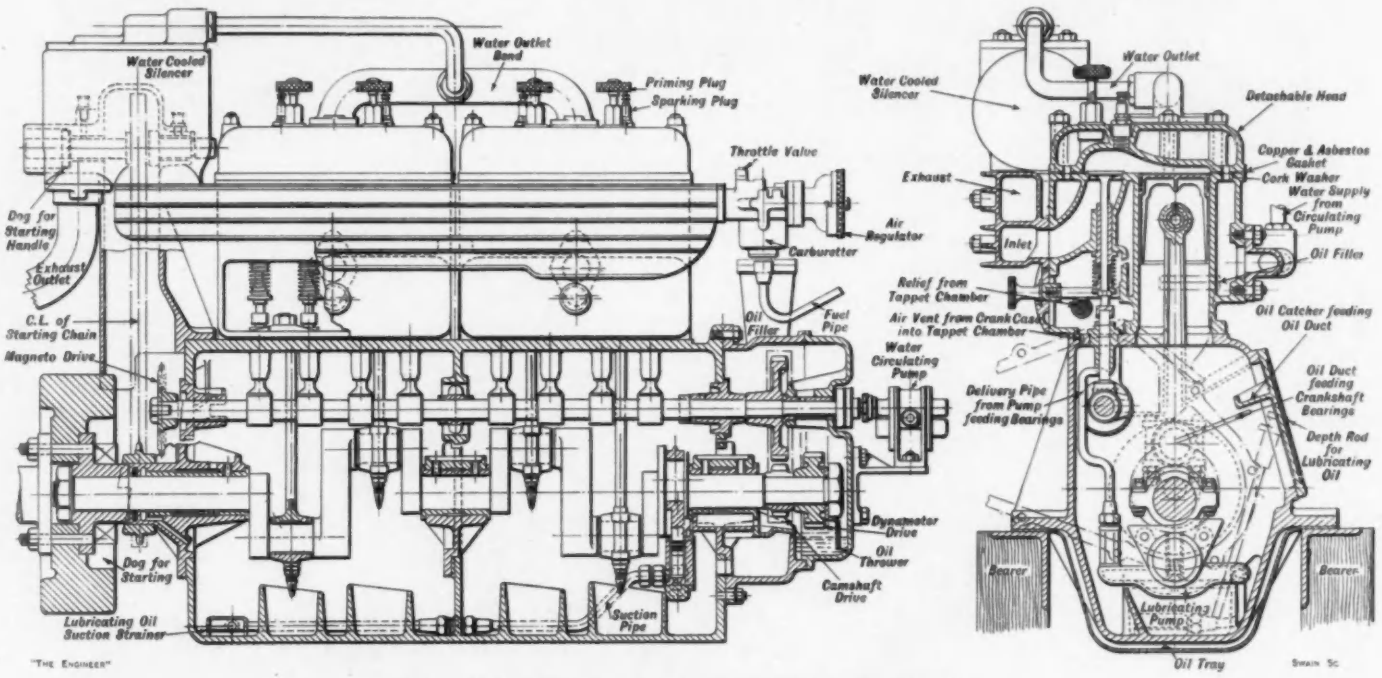



FIG. 33—16 B.H.P. MARINE OIL ENGINE—HEATLY-GRESHAM

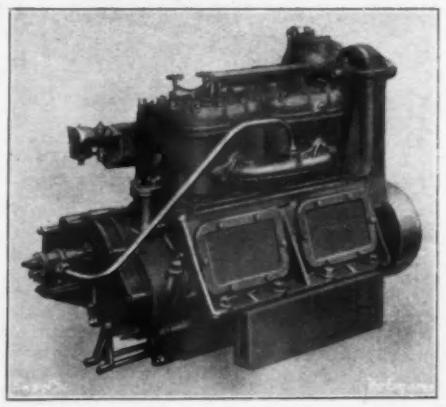


FIG. 35—MARINE OIL ENGINE—HEATLY-GRESHAM

Other exhibits by this firm comprise a range of an ordinary foundry run of grey iron castings, which are produced by the firm, and there is also a display of pressings and forgings from which the interchangeable component parts of the engines and exhausters built by the firm are made.

boiler sections. Such an arrangement appears to eliminate many of the complications at present associated with large output high-pressure units, and incidentally provides—in the low-pressure boiler section—a potential method of thermal storage.

Waste heat recovery represents one of the cheapest forms of power generation, its only near competitor on the basis of overall cost being low-grade fuel used at its point of origin, *i.e.*, with no added transport charges. Owing to expensive head works, &c., water power in this country is much more expensive. Further as waste heat occurs in the manufacturing districts where power is most required, transmission costs are less than in the case of water power. In a paper* dealing with the generation of electricity by tidal power, Professor Miles Walker instanced the Severn barrage scheme, the estimated cost of which was £28,000,000. Of this, £2,500,000 represented the cost of the railway and road bridge. The purely hydro-electric portion of the scheme was therefore assessed at £25,500,000, excluding transmission lines to the Midlands and London. The average output was estimated at about 200,000 horse-power; capitalisation therefore worked out at £127½ per horse-power. A potential reduction of £8,000,000 was shown to be possible on the original estimate of cost, reducing the total expenditure to £17,500,000, and at this revised figure, the capitalisation became £87½ per horse-power.

The author compared these figures at that time with a waste heat recovery scheme which he had then just completed for his company. The total outlay on that particular scheme was £27,000, including boilers, generating set and all accessories and details, completely erected. The power yield was 1500 H.P., so that capitalisation worked out at £18 per horse-power, *i.e.*, about one-fifth of the cost of the water-power scheme. In this case, owing to the comparatively small size of the plant, the prime mover was less efficient than is usual with larger installations.

Although it is not claimed that proper attention to waste heat recovery problems in our basic industries will in itself completely regain the world's markets for our products, the subject is one of the important factors which make for economic production based on post-war requirements. Other factors are: better internal transport facilities in works and better co-ordination of services and effort throughout.

If engineers responsible for the design, construction and operation of the heat-using apparatus mentioned in this paper will appreciate the extent to which heat otherwise wasted can be returned to the credit side of the balance sheet, they will take adequate steps to utilise it after it has fulfilled its primary function, and they will also endeavour to lower the percentage of heat lost through other channels which do not admit of effective recovery.

## Books of Reference.

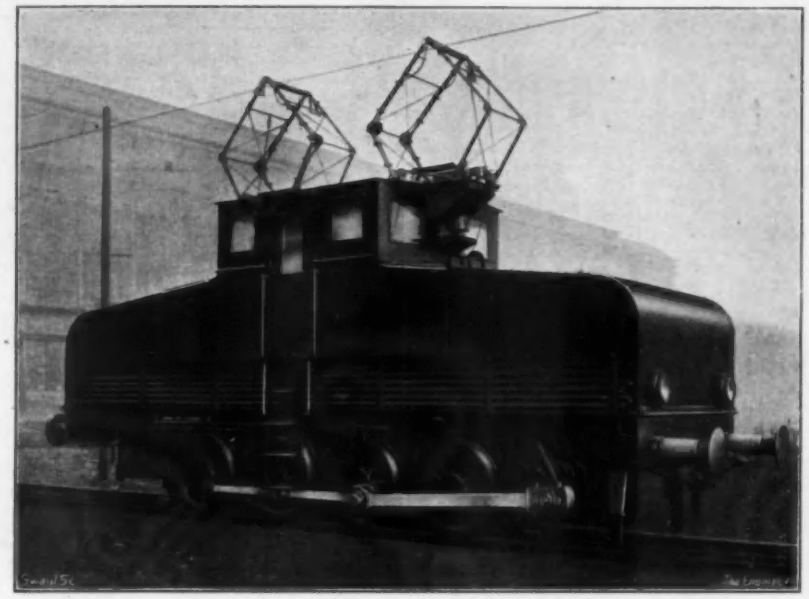
"THE Directory of Shipowners, Shipbuilders and Marine Engineers," 1928. Twenty-sixth edition. Published by the Directory Publishing Company, Ltd., 33, Tothill-street, Westminster, London, S.W. 1. Price 20s. net.—This yearly volume, which is compiled under the direction of the editor of *Shipbuilding and Shipping Record*, is fuller than that of last year, and it now contains over 24,000 references to shipping and shipbuilding matters. As a work of reference it is almost indispensable to the shipowner, the shipbuilder and the marine engineer, since, from the information it gives, the owners and managers of a given ship can immediately be found, together with full details of her age, dimensions and tonnage, her builders, and the makers of her propelling machinery. Another important service which the directory renders is the information it gives as to the building capacities of shipyards both at home and abroad, and the names of shipyard directors and officials. Full particulars are given of the Admiralty and other Government Departments, together with information with regard to British and foreign classification societies. A list of consulting marine engineers and naval architects is also given and is supplemented by a directory of trade and technical associations and institutions. The indexing of the directory has been rendered even more complete by additional cross references in the shipowners' section, which appear for the first time in the new edition.

"THE Motor Ship Reference Book," 1928. Compiled by the staff of the *Motor Ship*. Published by Temple Press, Ltd., 5–15, Rosebery-avenue, London, E.C. 1. Price 5s. net.—In the fourth annual edition of this very useful book particulars are given of practically every type of propelling machinery which has been installed in a motor vessel. This information is supplemented by excellent drawings of the different types, including the most recent double-acting and opposed-piston engines, as well as experimental units. The development of the motor vessel during 1927 is discussed and the noteworthy ships of the year are illustrated. Information is given with regard to Lloyd's Rules for the construction and survey of motor ship machinery, and the Board of Trade regulations with reference to the qualifications required for motor ship engineers. A useful feature of the book is a list of all motor vessels above 2000 tons gross which have been built or were ordered up to the end of 1927. A list, which is arranged alphabetically according to the name of the vessel, embraces all motor ships built up to 1924, and separate lists are made for the years 1925, 1926, and 1927. The list of ships on order at the end of last year is arranged alphabetically according to the names of the owners, and it gives information as to the dimensions of the ships and the type and power of the propelling machinery which will be installed. The question of auxiliaries for motor vessels is dealt with and typical engine-room arrangements are illustrated. The book is one which may be read and consulted with advantage by all who are interested in this most recent and important branch of shipbuilding and marine engineering.

* Report of the Smoke Abatement Conference, Manchester, 1924.

## 50-CYCLE SINGLE-PHASE ELECTRIC LOCOMOTIVE

FRIED KRUPP AKTIENGESELLSCHAFT, ESSEN, ENGINEERS



## Fifty-Cycle Single-Phase Locomotives.

WHILE it is generally agreed that the practice of converting alternating current into direct current in rotary converter sub-stations adds materially to the cost of electricity, and that it is more economical to distribute current by means of a high-pressure alternating-current system than it is to distribute it in the form of low-pressure direct current, alternating-current electric traction is not favoured in this country. Elsewhere, however, and notably on the Continent of Europe, the single-phase high-pressure system has been adopted on an extensive scale, and not a few continental engineers maintain that, for main line work at any rate, it offers considerable advantages. In the past its principal drawback was that owing to difficulties of designing motors for the standard frequency of 50 cycles per second, a lower frequency has had to be adopted, with the result that the traction supply could not be taken direct from power stations that deal with ordinary industrial loads. It has long appeared to us, however, that sooner or later the difficulties in the way of building 50-cycle single-phase locomotives would be overcome, and that a relatively simple and cheap system of railway electrification would be devised. In Hungary a 50-cycle single-phase traction scheme has been under consideration for a considerable time, but owing to financial difficulties it has not yet materialised. Moreover, in our issue of June 11th, 1926, we described a compensated 50-cycle railway motor introduced by Krupp, and fitted to an electric locomotive. Two other locomotives equipped with this patented motor have recently been built by Krupp for service with a stripping dredger used for winning lignite at a mine in Germany. The duty of these engines—one of which is shown in the accompanying illustration—is somewhat severe, as 1400-ton trains have constantly to be started and stopped, each car being loaded separately from the dredger hopper. The main characteristics of these 50-cycle single-phase engines are given in the following table:—

| | |
|---|---|
| Gauge | 4ft. 8½in. |
| Diameter of driving wheels | 3ft. 5in. |
| Service weight | 48 metric tons |
| Axle load | 12 metric tons |
| Maximum tractive effort | 35,270 lb. |
| Maximum speed | 7·45 m.p.h. |
| Motor B.H.P. (one-hour rating), two motors each | 320 B.H.P. |
| Trolley wire pressure | 3000 volts |
| Periodicity | 50 cycles per second |
| R.p.m. of motors at train speed of 7·45 m.p.h. | 750 |

Details of the motors fitted to these new locomotives will be found in the article to which we have alluded.

## The South-East England Electricity Scheme.

ON September 29th of last year the Electricity Commissioners transmitted their scheme for the South-East England area to the Central Electricity Board, and in accordance with the Electricity (Supply) Act, the Board published the scheme as it had received it on October 4th, and indicated that it was prepared to receive representations from authorised undertakers and other persons interested by November 15th. Since that date the Board has held Conferences with the undertakers who made representations, and has examined the scheme closely in the light of the representations put before it, and in the light of inquiries made at many of the undertakings in the area. The Board has now adopted the scheme with certain modifications, which have been deemed to be desirable as the result of the representations, conferences, and inquiries. In preparing the scheme and forecast of progress, the Commissioners based their calculations on the latest available figures and made allowance for improvement in working.

Many of the undertakers pointed out, however, that the rate of improvement of their efficiency was greater than that assumed by the Commissioners, and the Board therefore thought it right to inquire into the progress that had been made. From the further information obtained two points became clear, namely:—(*a*) That the improvements in individual stations, which, on the basis of the 1925–1926 figures the Commissioners had foreshadowed, were conservatively estimated, and is in the process of being attained; and (*b*) that the rate of growth of consumption upon which the Commissioners had worked is, in the early years, and taking the area as a whole, conservative rather than optimistic. As a result of the conclusions, reached after considering the representations and conducting these further investigations, the Board was satisfied that the scheme in its general outline is sound, but that certain modifications in detail could be advantageously made. The Commissioners proposed that, of the 135 public supply generating stations existing in the area, thirteen should be selected, and that a further fifteen should be employed to supplement the operation of the scheme in the same manner as selected stations for a period of years without being actually selected. The Board is satisfied that several of the municipal stations included in the latter fifteen offer facilities for advantageous expansion, and that benefits would, on the whole, be secured by making these fifteen stations selected stations, and developing the facilities of some of them for the general purpose of the scheme. In addition, the Board has thought it desirable to select the stations at Fulham, Maidstone, and Bedford. As there is a possibility that the growth of consumption will be in excess of the Commissioners' estimates, the Board feels that it is desirable that it should have under its permanent control a greater margin of the existing plant available to meet this possible expansion than the scheme at first provided, and that so far as extensions to plant are concerned, it is advisable to retain some flexibility. The Board has come to the conclusion, therefore, that, rather than schedule extensions at present, it should be guided by the experience that will be available of the actual growth and its location.

Impressed with the need to see that existing undertakings were afforded the fullest opportunity of making economic contribution to the scheme, the Board examined with special care the riverside sites. It found that on several of these sites expansion might be encouraged in the interests of the scheme as a whole beyond the limitations by which up to now local authorities have been bound in providing only for their immediate needs. On one site, in particular, namely, Fulham, economic development of a very large order can be undertaken. In view of its position and proximity to the load to be met in the West End of London—with consequent important saving in the cost of transmission system—as well as in the light of its advantages in other directions, the Board has felt it right to rely for the present on the development of the Fulham site, and the extended use of others in substitution for the station which the Commissioners had scheduled at Chiswick for 1934–35. Certain variations have been made in the route of the transmission lines both as a consequence of the modifications which the Board has made in the scheme, and as a result of representations bearing upon technical considerations.

## INSTITUTION OF ELECTRICAL ENGINEERS.

THIS year's summer meeting of the Institution of Electrical Engineers will be held in Norway from June 9th to 24th. The tour will include a visit to Trollhättan in Sweden on the return journey. The provisional programme is as follows:—On Saturday, June 9th, the party will leave Newcastle by steamer at 5 p.m., and will arrive at Bergen at 9.30 p.m. on the following day. On the Monday the Bergen National Exhibition, the Flöyen funicular railway, &c., will be inspected.

On Tuesday, June 12th, the members will leave Bergen by special train early in the morning for Dale (42 miles), and after seeing the hydro-electric power works there, they will proceed by the special train to Voss (25 miles),

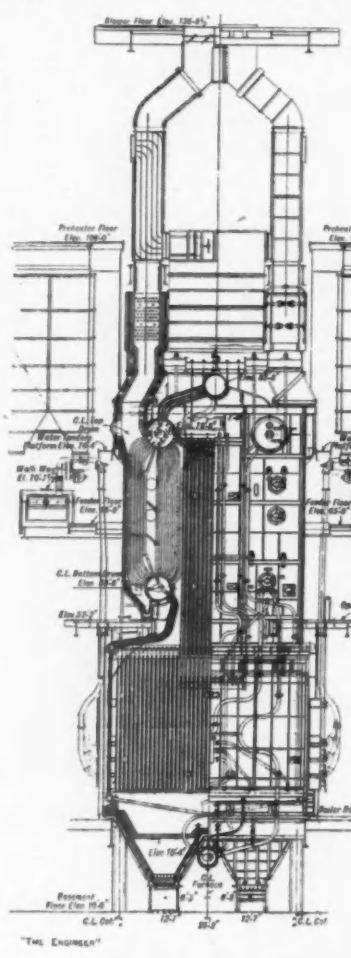
and thence by motor cars to Eide and Ulvik. On the Wednesday they will proceed by steamer from Eide and Ulvik—visiting the Björlvefoss hydro-electric works *en route*—to Tyssedal and Odda, arriving in the afternoon, and will visit the zinc smelting, carbide and aluminium factories and the power works. The night will be passed at Odda.

In the afternoon of Thursday, June 14th, the party will leave Odda by steamer for Eide and Ulvik, and on the next day will leave for Voss by motor cars and from there proceed by train to Oslo. From Saturday, June 16th, to Wednesday, June 20th, the headquarters of the party will be at Oslo, and various visits and excursions will be arranged, including alternative visits to—(1) the nitrate factories and power works at Rjukan, and (2) the power works at Vamma and Solbergfos, and also possibly at Ranasfos and Nore. On Thursday, June 21st, at 7.40 a.m. train will be taken for Trölhättan, and after inspecting the hydro-electric station there, the journey will be continued to Gothenburg, whence train will be taken the next afternoon for Hamburg, the return to this country being made *viâ* the Hook of Holland and Harwich. London will be reached in the morning of Sunday, June 24th.

## Powdered Fuel and Turbulence.

IN the second article of "An American Diary"—see THE ENGINEER, August 5th, 1927—some illustrations and particulars of the boilers in the Kip's Bay steam heat station, New York, were given. At the beginning of last year three boilers were complete and in operation. They are fired with powdered fuel admitted through burners at the summit of the fire-box and directed downwards. That is the familiar Lopulco system necessitated by the length of the flame. These boilers can evaporate 300,000 lb. to 325,000 lb. of steam per hour. A fourth boiler has now been completed. It differs in two or three respects from the first three, the most important modification being the adoption of high-velocity powdered fuel burners. With these burners combustion is completed much more rapidly. The flame is therefore much shorter and the necessity for directing it downwards no longer exists.

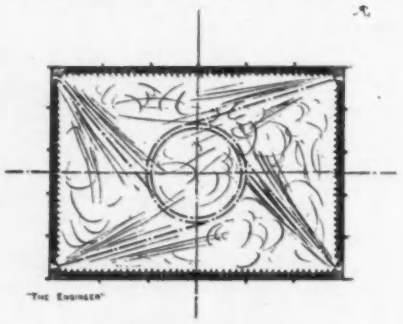
The new boiler occupies exactly the same space as any one of its predecessors, but in view of the anticipated increased combustion rate the total heating surface has been raised to 20,904 square feet. It will, we are informed, generate no less than 425,000 lb. of steam per hour without undue forcing. The furnace has the same volume as the older boilers; it measures in plan 20ft. 4in. by 28ft. 3in. inside, and is about 24ft. high. The total combustion space, that is to say, the volume of the furnace itself plus the volume between the two banks of convection tubes—see the drawing—is 18,900 cubic



NEW BOILER AT KIP'S BAY

feet, and the rate of combustion for this whole space is 30,000 B.Th.U. per hour per cubic foot. The radiant heat receiving surface is 5214 square feet, and the surface in the two banks of tubes is 15,690 square feet, thus making the total of 20,904 square feet already given. Hence, when evaporating 425,000 lb. of water per hour from and at 212 deg. Fah.—the normal comfortable rate—over 20 lb. of water are evaporated per square foot of heating surface per hour. The coal varies, but 14,000 B.Th.U. may be taken as representative of an average sample.

The chief interest in the design is to be found in the furnace arrangements to which we have already referred. The burners no longer enter at the top of the fire-box, but are arranged in four groups of three each at the corners of the furnace, as shown in the accompanying sketch. The



TURBULENT COMBUSTION

three burners at each corner are placed one above the other, the lowest being only a few feet above the water screen and the highest well below the transverse centre line. The pressure in the coal pipes just before the coal enters the furnace is 1½ins. The flames are directed at a tangent to an imaginary circle in the centre of the furnace, and in that area combustion is very intense. Hence, a great amount of heat is given by radiation to the water walls, which surround the flame on four sides. But there is violent turbulence of the hot gases, and by sweeping against the walls they part with some of the heat by direct convection. These cooled gases ascend in spirals, and are immediately replaced by hotter gases whirled outwards from the centre. Hence, the water walls—which in this case may be regarded as the principal steam generating portion of the boiler—not only receive heat by radiation from the intensely hot mass of gases at the centre, but also by direct contact from gases moving at a high velocity over them, conditions which, as is well known, are conducive to a high rate of heat flow.

After leaving the furnace proper, the gases ascend into a lofty combustion space, closed at each end by water walls, and thence turn to left and right through vertical tube elements of the Ladd type. There are no superheaters, but the gases give up their remaining heat to huge air preheaters, which supply the furnace with both primary and secondary air.

The design will be recognised by those who have followed boiler development as an application of the principle advocated by Mr. W. R. Wood, vice-president of the International Combustion Engineering Corporation of New York and London. The astonishing increase in the evaporation rate by the employment of a radiant heat furnace, which is made possible by the employment of high-velocity burners, opens out further fields for development. Long before water walls came into use, engineers, particularly those who used internally-fired boilers, recognised the importance of radiation, but not until Mr. Wood took the bold step of making the water walls—which at first were no more than a means of obviating the use of refractories—the essential part of the boiler had the full advantage of radiant heat been explored. His boiler is essentially a powdered fuel boiler. It is impossible to see how the same principle could be applied in a solid fuel furnace, but where enormous rates of combustion and evaporation are called for, it opens up new possibilities. The next question to which engineers will direct their attention is the endurance of steel tubes under a rate of heat flow more than half as fast again as that in common use.

## SIXTY YEARS AGO.

IT is a remarkable testimony to Faraday's greatness as a scientific investigator that within less than a twelvemonth of his death his discoveries could be made the subject of a series of popular lectures at the Royal Institution. General interest in scientific matters was neither so widespread nor so intelligent then as now, but it is evident that Faraday as a man and as a scientist had in his lifetime attracted the attention and esteem of people outside the limited ranks of those who were in a position fully to appreciate the significance of his work. Something may be set down to the natural interest which the public found in the growing wonders of electrical discovery. Some of the interest in the Royal Institution lectures may, too, be ascribed to the fact that the lecturer was Professor Tyndall. The lectures were briefly reported in our issue of February 21st, 1868. The course was illuminated by experiments. One of the experiments which we described as "most curious" will now be recognised as demonstrating what afterwards came to be called eddy currents. A copper tube filled with a fusible alloy of bismuth was spun rapidly between the poles of a powerful electro-magnet at right angles to the magnetic force. The strange force acting between the poles, we explained, offered resistance to the rotation of the copper tube which moved as if surrounded by a viscous substance like cheese or butter. In time the resistance caused the tube to become hot and the alloy to melt. Among the apparatus used by Professor Tyndall to demonstrate Faraday's experiments was a "coil machine," the property of Mr. Gassiatt, F.R.S., and made in the United States. It was stated to give a spark nearly a foot long, and to be the most powerful machine of its kind then in England. It consisted of a glass tube about 2ft. long containing an iron core round which the primary coil was wound. The secondary coil was placed outside the glass tube and was made in three sections separated by glass plates intended to reduce the damage done should the insulation of the secondary coil fail at any point. The contact-breaker for the coil was operated by hand. Our report gave no indication of what experiments were carried out with this coil, but we duly recorded the lecturer's remarks concerning what would happen if a human body received a spark from it. He did not know what the exact effect would be, but he thought it possible that there would be no pain experienced and that all sensation would be lost by reason of the extreme violence and suddenness of the shock. He could not tell whether sensation would return afterwards. On the other hand, Mr. Grove, Q.C., was quite certain that a single shock from the machine would kill a man.

## B.E.S.A. Specifications.

### STEEL FISH-PLATES FOR BULL HEAD AND FLAT BOTTOM RAILWAY RAILS.

A REVISED edition of British Standard Specification No. 47, Steel Fish-plates for British Standard Bull Head and Flat Bottom Railway Rails has just been issued by the British Engineering Standards Association. This specification was first published in 1909, and earlier revisions were issued in 1914 and 1919. As regards the fish-plates for the flat-bottom rails, the new issue gives details of the sections for use with the revised series of rails included in B.S. Specification No. 11, 1926, for F. B. Railway Rails. In addition to the angle type, a fish-plate having a shortened flange is included, as in the previous editions, for use in cases where certain types of metal sleepers are employed or where it is preferred to drive the spikes into wooden sleepers without interference with the fish-plate. The range of 6-bolt fish-plates now extends over the whole series instead of beginning with the section for the 65 lb. rail as hitherto. Round bolt holes for both rails and fish-plates have been adopted, and the length of the fish bolts and of their screwed portions and the form of the nut are now specified. As the peak neck is thus abolished, a square headed bolt has been adopted engaging with a projecting ledge on the fish-plate to prevent turning. As regards the fish-plates for the bull head rails, no changes have been made in the sections or holing. Full size drawings of all the fish-plates are included for the first time.

The principal alterations in the text of the specification are the omission of the Bessemer basic process, the raising of the upper limit for carbon for Class B steel, and the increasing of the maximum limits for phosphorus and sulphur in both classes. Apart from the analysis, the substance of the specification has been very little changed, but the general form has been modified so as to bring it into line with the current editions of the B.S. Specifications for railway rails and for tramway rails and fish-plates. Copies of this specification (No. 47, 1928) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 6s. post free.

### FIELD RHEOSTATS.

A NEW specification just issued by the British Engineering Standards Association applies to field rheostats for electric generators, motors, synchronous converters and balances, with direct-current excitation. The rheostats are intended to be used for all standard electrical voltages up to and including 660 volts. The following methods of operation are recognised as standard :—(*a*) Direct hand-operation ; (*b*) remote hand-operation ; (*c*) remote electrical operation.

The following methods of mounting are recognised as standard :—(*a*) Front-of-board and wall mounting ; (*b*) back-of-board mounting ; (*c*) floor mounting ; (*d*) ceiling mounting.

A comprehensive list of definitions of types of rheostats and of types of enclosures are given, and the specification proper deals with the current rating of the regulating switch and of the resister, general construction, temperature limits, non-interruption of field circuit, grading of resistances, &c. The tests on standard rheostats are also set out. Appendices deal with (*a*) information to be applied to the maker with inquiry ; and (*b*) direction of rotation of the operating mechanism.

Copies of the specification (No. 280, 1928) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, S.W. 1, price 2s. 2d. post free.

### TRANSLUCENT GLASSWARE FITTINGS.

A specification for Translucent Glassware Illumination Fittings for Interior Lighting—No. 324, 1928—just issued by the B.E.S.A., states that the expression "translucent glassware" shall be taken to include only satin-finished glass, frosted glass, sprayed enamel glass, opal glass, flashed opal glass, and glass having a milky texture, and not any form of decorative glassware. After specifying the general conditions of the glassware and requiring the type, maximum rating and position of the light source to be clearly stated by the manufacturer, a table of the neck dimensions of totally enclosed and bowl fittings and metal work, for both electric and gas lighting, is given. In order to safeguard against the likelihood of cracking or deterioration owing to overheating, a heat resistance test has been included, and it is also required that in the case of electric light fittings the fitting shall be so designed that the internal leads do not become heated to such an extent as to cause any dangerous effects. The diffusing power, brightness and performance of the fitting are also dealt with and a testing clause covers the selection and testing, whilst the two appendices give respectively methods of flux and brightness measurement. Copies of the specification—No. 324, 1928—may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

A NEW gasworks is to be put up at Warsaw by West's Gas Improvement Company, of Manchester. The value of the contract is £140,000.

# Provincial Letters.

## THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

### Market Conditions.

APART from the developments due to the efforts of steelmasters to combat continental competition, there has been little to affect the Midland iron and steel market this week. The basic industries find the anticipated trade expansion proceeding almost too slowly to be perceptible. Demand is illiberal both for iron and steel, though it is expanding in some of the minor branches. Business in engineering circles is quiet, but a few of the Midland manufacturing works display signs of increased activity, and the general tendency seems to be in the right direction. At any rate, industrialists hereabouts remain optimistic.

### Steel Price Readjustment.

The readjustment of prices of steel sections announced by steelmasters last week came as something of a surprise to Midland engineers, and many of them, who have been handling foreign material, together with the merchants, do not relish this method of putting the screw on them to force them to take advantage of the rebate scheme. The cost to buyers outside the rebate scheme has been advanced 5s. a ton, which means that the new prices of angles and joists will be £7 17s. 6d. and plates £8 12s. 6d. In order to exempt from the increase consumers who confine themselves to British material, the rebate on joists is increased to 12s. 6d., and on all the other defined materials to 10s. Since the rebate scheme was given effect to nearly six months ago, traders who did not take the pledge to handle only British steel have had to pay 5s. more for sections and plates, and 7s. 6d. more for joists, than was paid by those who confined themselves to the home products. The addition of 5s. now made to the basis has the effect of increasing the difference to 10s. and 12s. 6d., inasmuch as the advantage will be returned in the shape of rebate to those qualified to receive it, plus the allowance of 5s. and 7s. 6d. previously credited to them. It would seem that such a preference must be decisive in competing for contracts in which the use of British steel is specified, for the penalty on those who handle the foreign article is doubled in the case of sections and plates, and nearly doubled in the case of joists. Those consumers whose allegiance has hitherto been divided will now have to make a definite decision one way or the other. At the time of writing the outcome of the steelmasters' action could not be gauged. It had been hoped that ere this some official statement would have been made as to the results to date of the rebate scheme, but such has not been the case. Those in opposition to the scheme contend that the big effort now being made to bring in buyers who have been handling foreign material is evidence of the small support already accorded it. British steelmasters will be assisted by the stringency which is now beginning to be felt in foreign materials. Prices continue to advance, and delivery dates to recede. Foreign semis are difficult to obtain. There were few, if any, continental billets on offer on 'Change in Birmingham to-day—Thursday. Nominally the price is £5 14s. to £5 15s. for 2in. Trade in sheet bars at about the same level is now effectively countered by the Welsh mills. Imported steel bars were about £6 10s., plates £7 7s., British sheet bars and steel strip can be obtained on more favourable terms than recently; and, of the latter, consumption continues to increase, some of the tube makers being very busy. Small bars are quoted at from £7 7s. 6d. to £7 10s. One of the effects of the German industrial crisis has been to curtail the supply of bright drawn steel to Midland consumers. This material is largely used in motor engineering and some good orders have been placed with British producers. There is keen competition between Northern and Midland works, however. A good demand exists for special steels required by toolmakers. Orders for constructional steel are small in bulk, and local mills producing this material are not able to make full time.

### Staffordshire Bar Iron.

In the Staffordshire iron trade the greatest activity continues to be in marked bars, which are in fairly good demand at £12 10s. Chain, cable and anchor iron, however, is also in moderately good request. Crown iron ranges between £9 7s. 6d. and £10 5s., and nut and bolt iron is £9. Wrought iron is being bought by rolling stock makers, who have a considerable amount of work in hand. The motor trade is absorbing large quantities of thin sheets, and fair sales are made for stamping purposes. Re-rollers are rather busier as the result of a better demand for tube, strip, which makes £11 10s. per ton. Internal and foreign competition in the lower grade irons remains very keen. Lancashire houses offer Crown bars at cut rates, and Belgian No. 3 iron for the nut and bolt trade, though now up to £6 5s. per ton delivered, is a tempting line when compared with Staffordshire made iron at £9.

### Galvanised Sheet Prices.

A quickened demand for galvanised sheets from India, South America, the East Indies, and indeed nearly all the principal overseas markets, has resulted in a stiffening of prices. A fortnight ago manufacturers of galvanised corrugated sheets of 24-gauge were eager to accept business at £13 per ton, to-day they want at least £13 5s. Many mills are well booked and cannot accept orders for delivery before April. With a likelihood of demand at home being stimulated by replacements necessitated by the recent destructive gales, some buyers have this week exhibited anxiety to cover themselves. The buying spurt has enabled mills to get the new price, and with the tendency for raw material to become dearer, sheet makers will probably endeavour to get still higher reward for their products. Demand for black sheets is not so good as it should be at this time of the year, but motor engineers are expected to place large contracts in the near future.

### Scrap.

The increasing use of Welsh billets has helped the scrap market. Heavy scrap for melting sells at £3 delivered South Wales, or £2 15s. in the Birmingham district.

### Pig Iron.

Midland blast-furnacemen are disposing of their foundry grade iron in small lots, very little going into stock. There is no pressure for supplies, and no desire on the part of consumers to enter into long date contracts. Smelters hold firmly to recent prices, and business transacted this week has been booked for Derbyshire foundry at £3 4s., Northamptonshire £3, and North Staffordshire at £3 3s. 6d. Continental foundry iron costs more than the local product, and importation has ceased in the Midland district. Forge iron sells very slowly, and it would be possible, it is thought, to get supplies at below the prices now named, viz., £2 19s. for Derbyshire and £2 14s. for Northamptonshire. There is insufficient business passing, however, to test prices in this department. There has been no development in the fuel position, and furnacemen are still buying furnace coke at from 12s. to 12s. 6d. per ton on the open market.

### Malleable Cast Iron.

The importance of technical control in the malleable cast iron industry was stressed by Mr. H. Field, of Messrs. W. Harper, Son and Co., Willenhall, in a paper given on Saturday last at a joint meeting of the Staffordshire Iron and Steel Institute, Birmingham Metallurgical Society, and Birmingham Local Section of the Institute of Metals. The subject of the paper was "Malleable Cast Iron," and the statements of Mr. Field, who is an acknowledged authority on the subject, carry much weight. In the course of a most interesting reading, Mr. Field said that the whiteheart malleable casting was probably favoured by the engineer less than any other product of the foundry industry, the main reason being its reputation for unreliability. The range between malleable castings at their best and their worst was exceedingly wide. Those of the first class were equal to mild steel, and those of the second class were worse than gray iron, for not only were they brittle, but they also combined with that shortcoming unmachinability. Examining the reasons for the existing unreliability, Mr. Field said that in many cases it was due solely to irregularity of section. In these castings, even under the best conditions of control, a thoroughly uniform product of best quality could not be guaranteed. From the metallurgist's point of view, any process which was the result of chemical change was capable of being controlled within fairly narrow limits, providing that the laws governing such chemical change could be elucidated. Beyond the difficulty of irregular section, the wide variation in the quality of malleable castings was due mainly to the man in control having little or no understanding of the chemistry of the process, or to inability to apply what knowledge he did possess through lack of equipment. The story of American malleable iron for the past twenty years was an outstanding example of what technical control could do. There were already firms in this country the malleable iron foundries of which were furnished with both men and equipment, and it might confidently be stated that they, and they alone, were the malleable makers who could give satisfaction to the engineers in the country. He believed that, if the makers of malleable castings would rise to the occasion, there was in this country an exceedingly wide field for their product, equal at least to the market created in America. Speaking of the superiority of blackheart castings over whiteheart, Mr. Field said that one great advantage held by blackheart iron was that irregularity of section did not cause irregular physical properties to anything like the same degree as occurred with European malleable. The first essential in the production of a good malleable of either variety was a white fracture in the unannealed iron. There was a wide range of analyses which would yield good malleable iron if treated as each analysis demanded, but the fracture of the original iron must in every case be perfectly white and free from graphite. In whiteheart malleable iron there was usually present a higher percentage of sulphur than was permissible in other commercial metals, either ferrous or non-ferrous. In his opinion, the provision of an improved annealing can for malleable work was an urgent necessity; it constituted an interesting problem for the metallurgist.

### Proposed Great Motorway.

Further details of the project for a great motorway to link the West Midland industrial area with Liverpool and the Mersey, to which I referred in my letter last week, are now available. The main outlines of the scheme are a £6,000,000 motor road, 80 miles long, from Birmingham to Liverpool, fenced on both sides, as level as possible, and with no pronounced bends, to be built within two years from the scheme fructifying, ten thousand men being employed in its construction. Tolls will be charged on all vehicles using the motorway, the suggested levy being one of a farthing per ton per mile, this charge being levied on the tonnage of the vehicle as well as the load carried. It is computed that the double journey will be made in the time it now takes to go the one way. Absence of inclines and fine road surface will reduce running costs. The basic idea behind the motorway is that when it is operating it will be possible to take merchandise from the factory gates to the port, or to send in from the ships the material that manufacturers require, without anything like the present amount of hindrance and delay being experienced during transit. From data collected by means of a census it appears that the volume of traffic between the Mersey and Birmingham at present is adequate to make the motorway a paying undertaking. Many Midland industrialists and public men are keenly in favour of the scheme, which is to be put before a further meeting of all the local authorities and industrial and financial interests of the Midlands. A large number of leading manufacturers and traders in the Midlands had been finding for many years a growing demand for facilities for export business in the conveyance of their goods from the centre of England to the seaports, and from the seaports to the factories, and they whole-heartedly support the proposal, and wish for it better success than attended the scheme for a similar motorway between London and Manchester a few years ago.

### Electric Power.

Great satisfaction is expressed by Birmingham and district industrialists at the announcement that the Electricity Commissioners have, after all, decided that there is a good case for special treatment of part of the Birmingham area in applying the unification scheme. The marking out of an inner zone in the supply areas of the Birmingham Corporation, and the Shropshire, Worcestershire and Staffordshire Electric Power Company, within which the twenty-five frequency will not be interfered with, has allayed local industrialists' apprehensions as to the serious trade dislocation which must inevitably have resulted from the enforcement of a rigid uniformity to the fifty frequency. It is felt that the Commissioners have been wise to see that the efficient operation of the Government scheme could not be endangered by permitting a district like Birmingham, where the electricity supply has been developed on a twenty-five frequency, to remain undisturbed as a self-contained unit.

### More Miners Receive Notice.

The position in the Cannock Chase coalfield, I regret to state, does not improve, and this week two hundred and seventy-five men employed at the Coppice Colliery, Heath Hayes, near Cannock, received fourteen days' notice to terminate their contracts. It is understood that the colliery company is closing down certain seams, which have been worked at a loss, in the hope that by doing so increased employment will be found for the remaining workmen in the profitable seams. This follows the closing of one of the pits of the West Cannock Colliery Company and notice to 700 men, as reported in my letter last week.

### Unemployment.

Though Birmingham set an excellent example last week in reducing its total of unemployed by 574 and was assisted by other Midland towns, the adverse action of Bilston, Cradley Heath, Peterborough, Redditch, Smethwick, Stourbridge and Brierley Hill, and Walsall reduced the total decline in the Midland area to one of 315. The total now stands at 140,993, of whom 104,473 are men, 28,731 women, 3655 boys and 4134 girls. The number of short-time workers included in the above total is less by over 1000 than a week ago.

## LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER.

### Exports of Textile Machinery.

IF shipments of British textile machinery are maintained throughout the present year at the level recorded for the opening month this branch of engineering will have little of which to complain so far as the overseas section of its trade is concerned. The total exports in January reached a value of £1,079,788, compared with £878,670 in the corresponding period of last year, and £888,895 in January, 1926. Of last month's shipments spinning and twisting machinery accounted for a value of £817,677 and weaving machinery for £187,863. British India was easily the most important market during the month under review, exports to that country amounting to no less than £255,349. Germany came second with £115,798, followed by Russia with £95,854, the Netherlands with £83,345, France with £54,067, the United States with £47,579, Japan with £42,052, South America with £40,364, Australia with £19,965, and China with £12,198, "other European countries" accounting for the satisfactory total of £262,750. The aggregate weight of the textile machinery exported during the period under review was 10,842 tons, against 8467 tons a year ago and 9330 tons in January, 1926.

### Turbine Plant for Stockport.

An interesting but not unexpected development has occurred in connection with the Stockport Corporation's call for tenders for turbine plant, a question which has been discussed in this column during the two previous weeks. At a specially convened meeting of the Town Council it was decided by a narrow margin of votes—28 to 26 to be precise—to rescind the resolution passed at its previous meeting by which the tender of a Swiss firm, amounting to £34,307, was accepted. It was further decided to issue fresh advertisements to a specification drawn up by the electrical engineer and approved by the Electricity Committee. Originally, the lowest British tender received was for £52,000, a figure which was reduced subsequently to £42,000. It is this reduction which is responsible for the new situation. It is interesting to record that the Swiss firm in question, Messrs. Escher, Wyss and Co., in the course of a letter which was communicated at the special meeting of the Town Council, denied that they were subsidised by the Swiss Government or that their workmen worked more than forty-eight hours a week, hours worked in excess of the forty-eight-hour week, it was pointed out, being paid for at the rate of 25 per cent. above the standard rate. A further meeting of the Town Council to consider the matter has been called for next Monday.

### Ship Canal Traffic and Developments.

The annual report of the directors of the Manchester Ship Canal Company, states that the sea-borne traffic last year was 6,099,636 tons, and was the second largest in the history of the concern, being exceeded only in the previous year when, however, there was an exceptional flow of traffic as the result of the cutting off of home supplies of coal. The report adds that the expenditure

out of capital during the year amounted to £485,050, that the deepening of the Ship Canal to 30ft. between Eastham, Ellesmere Port and Stanlow oil dock has been completed, and that the reinforced concrete wharf and coal-handling plant at Ellesmere Port are approaching completion.

**Closing a Colliery.**

The oldest colliery in Lancashire, if not in the whole of the country, is to be closed down as the result of bad trade. The Clifton and Kearsley Coal Company is the owner of the pit in question—the Wet Earth Colliery at Clifton, which has been worked for at least 187 years. The same company has also decided to close down the Victoria Mine at its Spindle Point Colliery, Kearsley. In both cases a resumption of operations, it is officially explained, will be dependent upon an improvement in trade conditions.

**Non-ferrous Metals.**

All sections of the non-ferrous metals market have appreciably weakened compared with a week ago. In the case of tin interest at one time was almost feverish, and the experience was probably far from healthy for a number of speculative holders of the metal, who, influenced by the persistent bearish tendency of prices early in the week, anxiously unloaded. From the lowest point touched there was a sudden recovery at one time, but it was not long maintained, and further declines in the early days of the present week have resulted in a net loss on balance of between £3 and £4 a ton in the case of cash metal. Forward positions have been less seriously affected, and the drop has been relatively unimportant. Refined copper has been maintained, and a moderate trade has been done with the consuming industries. The demand for lead has continued on quiet lines and prices have fallen with the reduction made by United States producing interests. Inquiry for spelter, also, has been within a relatively small compass, and here, again, a rather important fall in market values has to be recorded.

**Iron.**

Consumers of pig iron in this district continue to conduct their buying operations on a very cautious scale, and producers are anxiously awaiting some indication of a general improvement, such as would enable them to secure at least less unremunerative rates for their products. There have been a few forward contracts placed on this market during the past week, but they have been singularly few, and it is no easy task for Midland iron-masters, who do the bulk of the trade with Lancashire users, to maintain quotations even at their present levels. Offers of Derbyshire No. 3 iron, for delivery Manchester or equal distance, range this week at from 72s. up to 72s. 6d. per ton, with Staffordshire makes quoted at 6d. to 1s. per ton less. North-East Coast sellers, however, are holding out for the 78s. per ton rate for delivery into this area, a figure which they have been asking for some time now. Users of Scottish pig iron have had the opportunity during the last few days of securing supplies at slightly more favourable prices, quotations in this section of the market now ranging from about 86s. per ton delivered. The position of hematite iron is virtually unchanged, current values being at 84s. 6d. per ton. Manufactured iron keeps quiet, but prices are steady with Lancashire firms quoting Crown bars at £10 per ton and seconds at £9 10s.

**Steel.**

Although here and there there have been somewhat better reports as to trading conditions in the steel market, no improvement from the point of view of contract buying has taken place, and, as before, practically the whole of the current business is on early delivery account. British makers of boiler plates offer this material at about £9 15s. per ton for basic varieties, with acid plates on offer at from £10 to £10 5s. Re-rollers have recently been attempting to secure higher prices for small steel bars, but it is doubtful whether they have been successful to any appreciable extent, for although the undertone is undoubtedly firmer than it has been for some considerable time as a result of the sharp advance in imported "semis," there are still plenty of offers at about £7 10s. Joists and sections at £7 17s. 6d., tank plates at £8 12s. 6d., and large steel bars at £8 17s. 6d. have all been advanced in accordance with the revision of the rebate scheme. The demand for continental materials on this market is on a very moderate scale, in spite of the steady climb in quotations. For delivery to users' works in this district, billets are now at £5 7s. 6d., sheet bars at £5 10s., angles at up to £6 10s., Siemens plates at £7 15s., Thomas plates at £7 5s., steel bars at £6 10s., and wire rods at £6 12s. 6d. per ton.

BARROW-IN-FURNESS.

**Hematite.**

There is no improvement in the condition of the hematite pig iron trade in the North-West district; neither industrially nor commercially is there any bright feature. There are two furnaces in blast at Barrow, and at Millom there are three operating. At Carnforth, Ulverston and Askam all the furnaces are idle. In Cumberland there is not much activity, and what there is would be less were it not for the demand on local steel makers' account. Refined iron is being produced at Backbarrow. It seems evident, according to some interested in the trade, that at present East Coast competition is keeping the West Coast trade quiet. This is possible, but in view of the cost of production on the East Coast, one cannot see how this condition can last any length of time. The overseas trade is dull, and small cargoes of special iron are being sent to Antwerp from Barrow. There is little else seaborne. The iron ore trade is quiet, and likely to be, and this applies to both local and foreign business. The steel trade is at present active, and the Siemens' departments, rail, merchant and hoop mills, together with the foundries are fairly well employed, but fresh orders would be very welcome. In Cumberland, the steel works are engaged upon railway material, and are assured of continuous work until probably Easter.

**Shipbuilding.**

There are no fresh orders to report with regard to shipbuilding at Barrow, but the prospects are not bad by any means, and it is possible that, within the next few weeks, announcement will be made of a further order.

## SHEFFIELD.

*(From our own Correspondent.)*

**A Steel Trade Review.**

LOOKING round the various departments of the local steel trade, one does not find evidence of much change from the position which has been reported in recent weeks. Taken as a whole, the industrial situation does not seem quite as good as it was before the Christmas stoppage. While a number of firms are doing better, from a profit-earning point of view, than they were a year ago, there are to be found many cases of bad and unremunerative working. The depression in crude steels remains acute. No relief has yet come from the expected falling off of continental competition; but the fact that our rivals are now charging higher prices for most iron and steel materials inspires confidence in the future. The wire rod trade has been subject to severe competition for several years, and the importations last month exceeded 10,000 tons. There is now a better outlook, however, owing to the fact that British prices have been substantially brought down, and are now little more than those of foreign makers. Buyers prefer the British steel, and already several instances are reported of business having been secured at home instead of being sent to the Continent, while many inquiries have been received from consumers who have hitherto gone abroad for their supplies. It is questionable whether the present British prices are remunerative, but they will improve in that respect if they bring sufficient orders to keep the plants fully employed. The manufacturing side of the steel trade is moderately well occupied, and specialities are in good request.

**The Lighter Trades.**

Variable conditions prevail in the tool trades. A satisfactory feature is an improved sale in this country for the smaller and cheaper twist drills. Sheffield prices have been reduced to about the foreign level, and a good deal of continental business has been captured. A less pleasing report comes from the saw trade. This has been in a depressed condition for twelve months, and shows no evidence of early revival. It has been seriously affected by the loss of the great Russian market and the falling off of the Japanese demand. The electro-plate trade continues to show a gain in strength, as compared with a few months ago, but the improvement in cutlery, which was noticeable in the beginning of the year, is hardly maintained. There is a good deal of activity in the cheapest lines, but the position of higher-class cutlery is disappointing. The demand for stainless knives is on an enormous scale, and Sheffield does almost all the trade; but the severe cutting of prices for the commoner qualities makes it very difficult for firms to obtain orders for goods of superior make. A speciality which has recently been introduced is a new type of bread knife with a saw-toothed edge, the sales of which are increasing rapidly.

**The Marking of Cutlery.**

The question of maintaining Sheffield's reputation for high-quality goods has been raised over and over again, and is one of the greatest importance. The Master Cutler, Mr. Percy W. Lee, emphasised it at the annual meeting of the Sheffield Advisory Committee last week. He drew attention to the inefficient marking of cutlery at the present time—by which, he said, he meant cutlery which was sent out without any name, but merely bearing neutral marks, which, as a rule, were an indication of poor quality. He said he would like to draw the attention of the public to the fact that unless knives were marked with the name of a reputable maker or other mark of good standing, they should look upon the quality with suspicion. "I think it would help Sheffield cutlery generally," he added, "if something of that kind were done." Mr. W. C. Veall, a cutlery manufacturer, supported the Master Cutler's remarks. He said there was still a large amount of stuff marked "Best Sheffield Cutlery" being hawked about, when it was nothing of the sort.

**Electricity Supplants Steam.**

A substitution of electric driving for steam has just been carried out by the Templeborough Rolling Mills Company, of Sheffield, which is associated with the United Steel Companies. Two powerful engines for driving the continuous rod mill were wrecked last June. The accident involved the loss of six months' output as well as the cost of restoring the plant. It was decided to install electric plant, and this has now been running for a few weeks, with such results that the management is well satisfied with the change over. Two motors are included, one of 2400 horse-power and the other of 1400 horse-power.

**Cammell's New Managing Director.**

Mr. Charles Lyall Mason has been appointed a director of Cammell Laird and Co., Ltd., and also managing director of the firm's Penistone and Sheffield works, in succession to Mr. J. M. Allan, who recently retired. Mr. Mason previously held the position of divisional carriage and wagon superintendent of the London, Midland and Scottish Railway, and was in charge of the carriage and wagon shops of that company at Wolverton.

**A Birmingham Development.**

A development in the manufacture of stainless steel in Birmingham is foreshadowed by the fact that Thos. Firth and Sons, Ltd., of Sheffield, has acquired the undertaking of Padley and Price, Ltd., of Blackheath. Messrs. Firth are one of the oldest firms of steel makers in Sheffield, and in recent years they have been very prominently associated with the introduction and development of stainless and corrosion-resisting steels. Padley and Price, whose business was formerly carried on in Sheffield, have for the past three years specially devoted their works to the manufacture of finished articles made from "Firth Staybrite." The policy of Messrs. Firth, as steel makers, is to encourage the use of these new materials by existing producers of the various articles. Their primary intention now is to develop the Birmingham works from the point of view of the supply of "Firth Staybrite" in the semi-manufactured condition, such as polished sheet and strip, welded and open joint tubes, &c., and for demonstrating the facility of working the material, which is continually finding new and increased application for industrial and domestic purposes.

**Water Schemes.**

A water scheme for the supply of villages and townships in South Yorkshire, which has already cost £127,000 and is to be extended, has been carried out by the Doncaster and Tickhill Joint Water Board, and was formally opened last week. A pumping station, equipped with electrical pumps, has been erected at Austerfield, near Bawtry; a reservoir with a capacity of 500,000 gallons constructed at Clifton Beacon, near Conisborough; and water towers, holding respectively 500,000 and 100,000 gallons, at Rossington and Bawtry. The bore-hole at Austerfield was sunk 572ft. into the red sandstone, and in test pumping 1,500,000 gallons of water were raised per day, but the pumps installed are capable of dealing with twice that quantity. The townships of Bawtry, Rossington, Edlington, Tickhill and adjacent villages are served by the new system. The situation of the reservoir is the highest point in the Board's district, the altitude being sufficient to supply such places as Askern, to which it is proposed to extend the scheme at a cost of upwards of £60,000. The engineers for the scheme were Messrs. D. Balfour and Sons, and the contractors William Wilson and Co., Ltd., both of Newcastle. A difficulty has arisen at Eyam, the well-known Peakland village, near Sheffield, owing to the fact that the reservoir constructed a year or more ago, at a cost of £13,000 or £14,000, has proved to be leaky, through some cause not yet discovered. Mr. Winser, consulting engineer, who was called in by the Bakewell Rural Council, found that the water went down about 7½in. in twenty-four hours. An examination of the empty reservoir did not lead to a solution of the problem, and it is to be filled again for the purposes of another test.

**Low-temperature Carbonisation.**

A further battery of retorts for the distillation of coal is to be erected during the next three months by Low-temperature Carbonisation, Ltd., at Barugh. It is officially announced that improvements, in respect of which the company holds a valuable new patent, will be incorporated. About thirty colliery companies have inquired as to the suitability of the process for use at their collieries, and the company is testing samples of their coal. Negotiations are, it is understood, in progress with local groups for the establishment of carbonisation works on a large scale at Newcastle and Nottingham, and it is expected that arrangements will shortly be concluded for the erection of two more plants in addition to those to be erected at Askern. Representatives from India, South Africa, Australia, Chile, America, Germany, Belgium and Japan have entered into negotiation with the company with regard to the possibility of extending the process to collieries abroad.

**Steel by New Process.**

It is reported by Edgar Allen and Co., Ltd., who installed a new high-frequency furnace for the production of high-speed steel a few weeks ago, that they are completely satisfied with the results. Independent tests to see how the new steel compared with three other types of high-speed steel were carried out, and according to the report the new steel proved itself five times as efficient as 14 per cent. tungsten high-speed steel and nearly three times as efficient as 18 per cent. tungsten high-speed steel. The firm expresses satisfaction that steels made in the high-frequency electric crucible furnace are superior to those made by the old crucible process or other processes. There is no contamination of the steel by gases, fuel or carbon electrodes; sulphur and phosphorus are eliminated to a greater extent than has ever been possible before; and the violent stirring of the molten metal results in thorough diffusion of the ingredients throughout the entire mass and gives the steel greater homogeneity.

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

**Iron and Steel Trade Outlook.**

IT is a long time since such a healthy atmosphere pervaded the iron and steel trade as that which is now being experienced. Business has expanded on an encouraging scale, and in the pig iron section some large orders have been booked, a significant development being the sale this week of 3000 tons of Cleveland iron for a French destination. Influences strengthening the position in this area include the threatened deadlock in Germany, which, if it comes to pass, will profoundly react on the situation here, and the continued crippling of continental competition by the Swedish ore trade strike. Prices of several descriptions of foreign material have advanced to levels that are barely competitive with Cleveland products in certain home consuming districts, and in seaboard areas of this country buyers of continental commodities are complaining of difficulty in securing regular deliveries against running contracts with firms abroad. Some customers are inclined to be rather cautious in their dealings just at present, but it is understood that they have nothing like fully covered their spring requirements.

### Cleveland Iron Trade.

The Cleveland pig iron trade is full of possibilities. Supplies of iron for the open market, after the needs of makers' own consuming plants have been arranged for, are not large, and as there seems a possibility of an enlargement in the overseas demand, some difficulty may shortly be experienced in meeting the needs fully. Makers' recent sales to Belgium and France have been followed by further continental inquiries. Home business promises to improve, and further transactions with consumers in Scotland are confidently looked for. Fixed prices are very firm, No. 1 Cleveland foundry iron being 67s. 6d.; No. 3 G.M.B., 65s.; No. 4 foundry, 64s.; and No. 4 forge, 63s. 6d.

### Hematite Pig Iron.

There is little change in the position of the East Coast hematite pig iron trade. Supply continues very ample, and while moderate home and continental inquiries are circulating, producers have to accept orders on unremunerative terms. Quotations are ruled by mixed numbers at 70s. per ton.

### Iron-making Materials.

Consumers of foreign ore are disinclined to negotiate for supplies, but sellers are taking a very firm stand, holding that values are likely to advance, and that there may be a shortage of supplies later in the year. Sellers now ask 21s. 6d. per ton for best Rubio ore, c.i.f. Tees. Durham blast-furnace coke prices show a further rise. Ironmasters are very disinclined to follow the advance, but there is a threatened scarcity of supply, and sellers put good average qualities at 18s. 3d. per ton delivered to the works in this area. Producers complain that they are still selling at a loss.

### Manufactured Iron and Steel.

Producers of finished iron and steel are actively employed, and fairly well sold. The rise in prices of semi-finished continental steel has opened out markets for manufacturers here, and there is more activity in finished steel as the result of the decrease in the margin of price between foreign material and the products of this district. Consumers who gave an undertaking to use solely British steel when the rebate scheme was introduced are not affected by the advance in certain commodities, as the rebate has been increased to cover the rise. There is a growing belief that an improvement in the export demand for the steel products of this area is at hand.

### The Coal Trade.

There is little or no change to record in the Northern coal trade. The collieries in both Durham and Northumberland are putting up a strong front against any price concessions as a result of the recent awards on miners' wages. They appear to be reconciled to the losing of odd days at the pits if trade does not come, rather than part with the benefit just received against losses. The miners themselves see the wisdom of this course, in preference to the alternative of lower-priced coals for the foreigner because of their sacrifice. A few orders have been placed at ruling prices, but the demand is not of any great volume. Inquiries, in fact, are very quiet, buyers evidently being content to wait and see if prices hold. They may reappear when it is found that there is no giving way. The speculator cannot do much at the moment, for there are not present any indications of cheaper coal. While everybody must approve the resolute efforts of the collieries to check any further drop in prices, some pessimists think that orders may go past this district through foreign—particularly Polish—offers at lower figures. In the meantime, collieries have fairly good orders to carry on with, and tonnage on hand to ensure steady shipments. This state of things, however, will be of short duration if no new business is booked. Collieries in Northumberland producing best steams are well employed at the moment. For best Blyth sorts the prevailing value is 13s. 6d., with Tyne primes quoted at 12s. 9d. to 13s., and seconds 11s. 9d. to 12s. There are good offerings of steam smalls at 8s. 6d. to 9s. for best Blyths, and at 8s. to 8s. 6d. for seconds. Specials are 9s. 6d. to 10s. Durham steams, large and small, and graded nuts have a fair trade at unchanged figures. Gas coals are in better demand, best qualities being steady at 15s. 6d. and seconds 13s. 3d. to 13s. 6d. Coking coal and ordinary grade bunkers are quoted easy, but first-class bunkers are scarce and firmly quoted. The coke trade for prompt supplies is heavily booked, and for any small parcels firm prices are indicated. For next month sellers offer freely, but definite business is scarce and quotations are just barely steady. Gas coke is quoted at 22s. 6d., patent oven cokes, good ordinary brands, 18s. to 19s.; special makes, 24s. to 25s.; beehive, 25s. to 30s.

## SCOTLAND.

*(From our own Correspondent.)*

### Little Change.

THE general situation in the steel, iron, and coal trades has not changed to any extent during the past week. Business in practically all departments is extremely modest, and there does not appear to be any definite reason to anticipate an early improvement. The rising tendency of continental prices in competitive material has undoubtedly engendered a much more hopeful feeling, and many are confident that the levelling up process will continue, and that ere long British materials will be in a very strong position. That steelmakers are confident is evidenced by their latest announcement regarding prices; meanwhile trade generally is largely confined to restricted prompt buying for immediate requirements.

### Steel.

The demand for steel products has not increased to any extent, and outputs are still considerably below the capacity of the works. Foreign competition is lessening, but home demands must increase before any definite improvement is noticeable. Shipbuilding yards are only moderately busy, a number of berths being still empty despite orders booked in recent months. With the yards busier, an entirely different complexion would be noted. Meanwhile heavy steel is not active. Steel sheets are uneven, the lighter gauges being fairly busy, while heavy sheets are quiet. Galvanised sheets are comparatively busy.

### Iron.

The demand for bar iron and re-rolled steel bars has not improved, and few works can see more than a week or two ahead. Home prices are unchanged, and the export quotations can still be shaded for a good prompt order. Crown iron bars for export are quoted £10, and re-rolled steel bars £7 per ton.

### Pig Iron.

Only twenty-five furnaces are in blast in Scotland, but the output is still more than ample to meet all demands, and stocks in makers' yards accumulate accordingly. Prices are unchanged.

### Exports and Imports.

During the past week 10,470 tons of iron ore and 1520 tons of steel and iron were unloaded at Glasgow harbour. Shipments of steel and iron totalled 6800 tons, which went chiefly to the Colonies. Exports of pig iron amounted to 317 tons.

### Coal.

The Scottish coal market continues dull, business generally being far below normal. Shippers are not disposed to discount colliery prices and export orders are very scarce. For prompt business the collieries are offering cheaper prices, but practically all fuels, with the exception of Lanarkshire splints, are comparatively inactive. Washed nuts are freely offered. Aggregate shipments for the past week amounted to 231,432 tons, against 254,419 tons in the preceding week and 215,782 tons in the same week last year. The home market likewise is inactive. Industrial and household coals are poorly bought, and only utility concerns are taking steady deliveries, mostly under contract.

### Relief Scheme in Coal Industry.

For some time past the heavy losses incurred since the period of abnormal depression set in have been a source of inquiry by a committee appointed by the Scottish Coalowners' Association. After exhaustive inquiries a scheme has been prepared, with the co-operation of sub-committees, and it is anticipated that it will probably be adopted at a general meeting of the Scottish Coalowners' Association. It is said that if the scheme is sanctioned there is little reason to doubt that some collieries will take advantage of the opportunity offered to close down and receive compensation from a fund levied on all coal sold for home consumption.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

### Coal Trade Conditions.

IT was something in the nature of a surprise to find that shipments for the week ended the 17th inst. amounted to round about 412,000 tons, as owing to the delay in the arrival of tonnage and the daily number of idle loading appliances it was thought that the total shipments would have suffered to an appreciable extent. The total of 412,000 tons compared with rather more than 405,000 tons for the preceding week. The figures for this week should be even better, as, although at the end of last week there were as many as forty-eight idle loading appliances at the various docks, the position on Monday last was much improved. Tonnage came to hand so well over the week-end that the report on Monday was that only nine loading appliances were idle, while there were nine vessels waiting to get into berth. From the tonnage point of view the conditions have not been better this year, yet at the same time it is impossible to predict that the coal industry is in for a more prosperous time, notwithstanding that chartering of late has been more active. Past experience has shown that any improvement that has taken place has been only of a very temporary character. Even now the foreign demand appears to be very dull. Certainly there are a few inquiries on the market, but the general flow of orders is on the whole meagre.

### Coal Stabilisation Scheme.

The announcement was made towards the end of last week by the Secretary of the South Wales Coal Marketing Association that, at a meeting of the Committee on Thursday, the deed and scheme were completed, and that it was arranged that on Tuesday of this week the document would be issued to all the colliery companies in the coalfield which employ more than fifty workmen. No statement as to when the scheme is to come into operation has been made, but in coal market circles it is stated that it will come into force as from March 1st. It is understood that, as regards the classification of coals, little amendment of the list has been made since it was returned to the Committee of the Association in January last. The report is current, however, that the provisional list of prices has been revised, and that the minima for the various groups provide for best Admiralty large at 19s.; ordinary Cardiff large at 18s. to 18s. 9d.; best dry large, 18s.; ordinary dry large, 17s. 3d. to 17s. 6d.; smalls, 12s. 6d. to 13s.; and through coals, 15s. to 15s. 6d. These prices approximate very closely to the figures now current on the market.

LATER.

The Committee of the Coal Marketing Association has since issued an amended classification list and minimum prices, but although no official information is forthcoming, it is understood that the scheme will not come into operation before the middle of March. The new classification list has to have the approval of the members of the Association, and it is expected that there will be a meeting of the members shortly to consider the position.

### Reparation Coals.

It is reported that the Reparations Commission in Berlin has informed the British Government that for the next three months the supply of Reparation coals to France and Italy will be as follows:—France, 1,000,000 tons per month; Italy, March 485,000 tons, April 505,000 tons, and May 525,000 tons. Deliveries to Italy last year were about 3,000,000 tons, representing a monthly average of a quarter of a million tons, but on the basis of the new programme this means over 6,000,000 tons during the current year. In the case of France, the programme provides for an increase upon the monthly average for 1927, which works out between one and two million tons for the present year as compared with last year. This news is undoubtedly perturbing, as the demand for coals by both France and Italy from this country will be adversely affected and South Wales will be the chief sufferer.

### The Steel Trade.

Interesting details of an appeal by Sir Frederick Mills, chairman of the Ebbw Vale Company, to the workmen to work longer hours were disclosed at the end of last week. The steel workers are working at the present time forty hours for the afternoon shift, forty hours for the night shift, and forty-seven hours for the day shift, and, if the appeal is agreed to by the men, it is stated that employment might be found for about 1500 men who are now idle. The appeal of the chairman of the company, which was posted up at the works, stated that the best way to meet foreign competition is by way of the biggest output. "If," proceeds the appeal, "I start an idle colliery, an idle coke oven and an idle blast-furnace, the pig iron made could not be blown and rolled in the present working week. Until I get the money to build mixers, I want a number of steel workers to work extra hours each shift once in three weeks on Sunday night and once in three weeks on Saturday afternoons; Bessemer to start at 6 p.m. on Sunday and work to 8 p.m. Saturday. It is, of course, understood that the working programme illustrated above embraces the whole scheme for extra time to meet the requirements arising by starting another colliery. Until these are started I want to work extra time on Sunday night only, but I must ask consent to the full scheme now so that the necessary preparations may be made. I make this appeal as a temporary measure until the new mixers are provided, when a return to the normal times will be made." The appeal was considered in private by the workmen on Saturday night, and their decision has so far not been divulged, but it is understood that the men have agreed to meet it partially, and as a matter of fact the men actually started work at the Bessemer on Sunday night at 6 p.m., and at the mill at 10 p.m., but it is reported that the workmen are opposed to work after 1 p.m. on Saturdays. However, there are to be further negotiations, which is very satisfactory.

### The Tin-plate Industry.

There was an important meeting of the Joint Industrial Council of the South Wales Tin-plate industry at Swansea on Friday last week, when the men's leaders submitted the men's case for a renewal of the former bonus for the process and highly paid men of 3½ per cent., with the stipulation that it should be granted unconditionally. The employers expressed willingness to refer the whole question back to the Joint Standing Committee, but emphasised the fact that the employers had gone to their very limit in offering 2½ per cent., provided that no claim was made on either side for the next six months. At the same time, they confirmed their willingness to allow annealers' and picklers' claims to be discussed by the Joint Standing Committee. This meeting was followed by another on Monday last of the men's delegates, when after consideration it was decided to refer the matter to a ballot of the men.

### Current Business.

There has been no alteration in the tone of the steam coal market, and prices in all classes have undergone no change. The inquiry generally is rather on the slow side, yet, at the same time, many of the leading colliery undertakings are for the time being well placed, as, in addition to tonnage which they have taken on recently, other steamers which have been delayed by bad weather have come along and loading operations are comparatively brisk. The patent fuel and coke markets are quiet, but pitwood is steadier.

A.M.I.E.E. EXAMINATION.—The next examination will be held on May 23rd, 24th and 25th, 1928. Candidates must be either students or graduates of the Institution or have lodged with the secretary a duly completed form "E" for election as associate member. Entry forms for the examination, which must be completed and returned by April 1st, and particulars regarding election to membership of the Institution may be had on application to the secretary, the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2.

INSTITUTION OF NAVAL ARCHITECTS: PREMIUMS.—The Council of the Institution of Naval Architects has awarded two premiums for the year 1927, one to Mr. H. J. R. Biles, for his paper on the "Effect of Wind Resistance on Superstructures and Ship Resistance," and the other to Mr. W. C. S. Wigley, for his paper on "Ship Wave Resistance: A Comparison of Mathematical Theory with Experimental Results, Part II." The premiums will be presented on March 28th next at the opening of the annual general meetings, which will be held at the Royal Society of Arts, John-street, W.C. 2.

TWO-PRESSURE HIGH-PRESSURE LOCOMOTIVE.—In connection with the article in our issue of January 20th, 1928, dealing with the two-pressure high-pressure locomotive, it was stated that the late Dr Schmidt was the inventor We have been asked to correct this statement, and would say that although the original inventions and tests for the introduction and use of high-pressure steam were made by the Schmidt'sche Heissdampf Gesellschaft m.b.H. under the direction and supervision of the late Dr. Schmidt, the inventive idea of combining the indirect steam generation in the fire-box with the ordinary longitudinal boiler into a double-pressure locomotive originated from Mr. Hartmann, the technical manager of the Schmidt'sche Heissdampf Gesellschaft m.b.H.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. COAST— | |
| Native | 19/- to 21/- |
| (1) Spanish | 19/- to 21/- |
| (1) N. African | 19/- to 21/- |
| N.E. COAST— | |
| Native | 18/- to 21/- |
| Foreign (c.i.f.) | 21.6 |

## PIG IRON.

| | Home. £ s. d | Export. £ s. d. |
|---|---|---|
| (2) SCOTLAND— | | |
| Hematite | 3 14 0 | — |
| No. 1 Foundry | 3 15 0 | — |
| No. 3 Foundry | 3 10 0 | — |
| N.E. COAST— | | |
| Hematite Mixed Nos. | 3 10 0 | 3 10 0 |
| No. 1 | 3 10 6 | 3 10 6 |
| Cleveland— | | |
| No. 1 | 3 7 6 | 3 7 6 |
| Silicious Iron | 3 7 6 | 3 7 6 |
| No. 3 G.M.B. | 3 5 0 | 3 5 0 |
| No. 4 Foundry | 3 4 0 | 3 4 0 |
| No. 4 Forge | 3 3 6 | 3 3 6 |
| Mottled | 3 3 0 | 3 3 0 |
| White | 3 3 0 | 3 3 0 |
| MIDLANDS— | | |
| (3) Staffs.— | | |
| All-mine (Cold Blast) | — | — |
| North Staffs. Forge | — | — |
| ,, ,, Foundry | 3 3 6 to 3 5 0 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 3 0 0 to 3 1 0 | — |
| Forge | 2 14 0 | — |
| (3) Derbyshire— | | |
| No. 3 Foundry | 3 4 0 to 3 4 6 | — |
| Forge | 2 19 0 | — |
| (3) Lincolnshire— | | |
| No. 3 Foundry | 3 4 0 | — |
| No. 4 Forge | 3 2 6 | — |
| Basic | 3 2 6 | — |
| (4) N.W. COAST— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 4 2 0 (a) | — |
| | 4 5 0 (b) | — |
| | 4 8 6 (c) | — |

## MANUFACTURED IRON.

| | Home. £ s. d | Export. £ s. d. |
|---|---|---|
| SCOTLAND— | | |
| Crown Bars | 10 5 0 | 10 0 0 |
| Best | — | — |
| N.E. COAST— | | |
| Iron Rivets | 11 5 0 | — |
| Common Bars | 10 5 0 | — |
| Best Bars | 10 15 0 | — |
| LANCS.— | | |
| Crown Bars | 10 0 0 | — |
| Second Quality Bars | 9 10 0 | — |
| Hoops | 13 0 0 | — |
| S. YORKS.— | | |
| Crown Bars | 10 10 0 | — |
| Best Bars | 11 0 0 | — |
| Hoops | 12 0 0 | — |
| MIDLANDS— | | |
| Crown Bars | 9 7 6 to 10 5 0 | — |
| Marked Bars (Staffs.) | 12 10 0 | — |
| Nut and Bolt Bars | 9 0 0 | — |
| Gas Tube Strip | 11 10 0 | — |

## STEEL. (d)

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) SCOTLAND— | | |
| Boiler Plates | 10 10 0 | 10 10 0 |
| Ship Plates, ½in. and up | 8 7 6 | 7 12 6 |
| Sections | 7 17 6 | 7 2 6 |
| Steel Sheets, ¼in. | 8 12 6 | 8 15 0 |
| Sheets (Gal. Cor. 24 B.G.) | 13 2 6 | 13 0 0 |

## STEEL (continued).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. COAST— | | |
| Ship Plates | 8 7 6 | — |
| Angles | 7 17 6 | — |
| Boiler Plates | 12 15 0 | — |
| Joists | 7 17 6 | — |
| Heavy Rails | 8 10 0 | — |
| Fish-plates | 12 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5 |
| Hard Billets | 8 2 6 | — |
| Soft Billets | 7 2 6 | — |
| N.W. COAST— | | |
| BARROW— | | |
| Heavy Rails | 8 5 0 | — |
| Light Rails | 8 10 0 to 8 15 0 | — |
| Billets | 7 10 0 to 10 0 0 | — |
| MANCHESTER— | | |
| Bars (Round) | 8 17 6 | — |
| ,, (Small Round) | 7 10 0 to 7 15 0 | — |
| Hoops (Baling) | 10 5 0 | 10 0 0 |
| ,, (Soft Steel) | 9 0 0 | 8 15 0 |
| Plates | 8 12 6 | — |
| ,, (Lancs. Boiler) | 10 0 0 | — |
| SHEFFIELD— | | |
| Siemens Acid Billets | 10 0 0 | — |
| Hard Basic | 7 12 6 to 8 2 6 | — |
| Intermediate Basic | 7 10 0 | — |
| Soft Basic | 6 10 0 | — |
| Hoops | 9 10 0 to 10 10 0 | — |
| Soft Wire Rods | 7 15 0 | — |
| MIDLANDS— | | |
| Small Rolled Bars | 7 7 6 to 8 0 0 | — |
| Billets and Sheet Bars | 6 0 0 to 6 5 0 | — |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | — |
| Galv. Sheets, f.o.b. L'pool | 13 5 0 | — |
| Angles | 7 17 6 | — |
| Joists | 7 17 6 | — |
| Tees | 8 17 6 | — |
| Bridge and Tank Plates | 8 12 6 | — |
| Boiler Plates | 11 0 0 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| SWANSEA— | |
| Tin-plates, I.C., 20 by 14 | 17/10½ to 18/1½ |
| Block Tin (cash) | 227 15 0 |
| ,, (three months) | 230 10 0 |
| Copper (cash) | 61 3 9 |
| ,, (three months) | 60 18 9 |
| Spanish Lead (cash) | 19 13 9 |
| ,, (three months) | 20 1 3 |
| Spelter (cash) | 25 1 3 |
| ,, (three months) | 25 1 3 |
| MANCHESTER— | |
| Copper, Best Selected Ingots | 66 10 0 |
| ,, Electrolytic | 67 0 0 |
| ,, Strong Sheets | 92 0 0 |
| ,, Tubes (Basis Price), lb. | 0 1 1 |
| Brass Tubes (Basis Price), lb. | 0 1 0 |
| ,, Condenser, lb. | 0 1 2 |
| Lead, English | 21 5 0 |
| ,, Foreign | 20 2 6 |
| Spelter | 25 5 0 |
| Aluminium (per ton) | £107 |

## FERRO ALLOYS.

| | Per Ton. | Per Unit. |
|---|---|---|
| Tungsten Metal Powder | 1/7½ per lb. | |
| Ferro Tungsten | 1/3 per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £22 15 0 | 7/6 |
| ,, ,, 6 p.c. to 8 p.c. ,, | £22 7 6 | 7/- |
| ,, ,, 8 p.c. to 10 p.c. ,, | £22 5 0 | 6/- |
| ,, ,, Specially refined | | |
| ,, ,, Max. 2 p.c. carbon | £35 10 0 | 12/- |
| ,, ,, ,, 1 p.c. carbon | £41 10 0 | 15/- |
| ,, ,, ,, 0·70 p.c. carbon | £52 0 0 | 17/- |
| ,, ,, ,, carbon free | 1/1 per lb. | |
| Metallic Chromium | 2/11 per lb. | |
| Ferro Manganese (per ton) | £13 10 0 for home | |
| | £13 10 0 for export | |
| ,, Silicon, 45 p.c. to 50 p.c. | £12 17 6 scale 5/- per unit | |
| ,, ,, 75 p.c. | £20 10 0 scale 6/- per unit | |
| ,, Vanadium | 14/3 per lb. | |
| ,, Molybdenum | 4/11 per lb. | |
| ,, Titanium (carbon free) | 0/11½ per lb. | |
| Nickel (per ton) | £175 | |
| Ferro-Cobalt | 9/- per lb. | |

## FUELS.

### SCOTLAND.

(*Prices not stable.*)

| | Export. |
|---|---|
| LANARKSHIRE— | |
| (f.o.b. Glasgow)—Steam | 14/6 |
| ,, ,, Ell | 15/- |
| ,, ,, Splint | 17/- to 17/6 |
| ,, ,, Trebles | 14/- |
| ,, ,, Doubles | 13/6 |
| ,, ,, Singles | 11/3 |
| AYRSHIRE— | |
| (f.o.b. Ports)—Steam | 13/3 |
| ,, ,, Jewel | 15/6 |
| ,, ,, Trebles | 14/6 |
| FIFESHIRE— | |
| (f.o.b. Methil or Burntisland)—Steam | 11/3 to 12/6 |
| Screened Navigation | 18/- |
| Trebles | 13/6 |
| Doubles | 13/- |
| Singles | 11/3 |
| LOTHIANS— | |
| (f.o.b. Leith)—Best Steam | 12/9 |
| Secondary Steam | 12/3 |
| Trebles | 13/- |
| Doubles | 13/- |
| Singles | 11/3 |

### ENGLAND.

| | |
|---|---|
| (8) N.W. COAST— | |
| Steams | 24/- to 25/- |
| Household | 37/6 to 50/- |
| Coke | 22/- to 23/6 |
| NORTHUMBERLAND— | |
| Best Steams | 13/6 |
| Second Steams | 11/9 to 12/- |
| Steam Smalls | 10/- |
| Unscreened | 11/9 to 12/- |
| Household | 21/- to 27/- |
| DURHAM— | |
| Best Gas | 15/3 |
| Second | 13/3 to 13/9 |
| Household | 21/- to 27/- |
| Foundry Coke | 18/6 to 19/- |
| SHEFFIELD— | Inland. |
| Best Hand-picked Branch | 27/6 to 29/6 — |
| Derbyshire Best Bright House | 20/6 to 21/6 — |
| Best House Coal | 19/- to 20/6 — |
| Screened House Coal | 16/- to 17/6 — |
| ,, ,, Nuts | 15/- to 16/- — |
| Yorkshire Hards | 14/6 to 15/6 — |
| Derbyshire Hards | 14/- to 15/6 — |
| Rough Slacks | 8/6 to 9/6 — |
| Nutty Slacks | 6/- to 7/- — |
| Smalls | 3/- to 4/6 — |
| Blast-furnace Coke (Inland) | 13/- at ovens — |
| Furnace and Foundry Coke (Export), f.o.b. | 17/- to 17/6 |

### (9) SOUTH WALES.

| | |
|---|---|
| CARDIFF— | |
| Steam Coals : | |
| Best Smokeless Large | 19/- to 19/6 |
| Second Smokeless Large | 18/6 to 19/- |
| Best Dry Large | 18/3 to 18/9 |
| Ordinary Dry Large | 17/6 to 18/- |
| Best Black Vein Large | 17/- to 17/3 |
| Western Valley Large | 16/9 to 17/- |
| Best Eastern Valley Large | 16/9 to 17/- |
| Ordinary Eastern Valley Large | 16/3 to 16/9 |
| Best Steam Smalls | 12/6 to 13/- |
| Ordinary Smalls | 11/- to 12/6 |
| Washed Nuts | 18/- to 23/- |
| No. 3 Rhondda Large | 20/- to 20/6 |
| ,, ,, Smalls | 14/9 to 15/3 |
| No. 2 ,, Large | 16/- to 16/6 |
| ,, ,, Through | 14/6 to 15/6 |
| ,, ,, Smalls | 12/6 to 13/6 |
| Foundry Coke (export) | 30/- to 37/6 |
| Furnace Coke (export) | 27/6 to 30/- |
| Patent Fuel | 22/6 to 24/- |
| Pitwood (ex ship) | 28/- to 28/6 |
| SWANSEA— | |
| Anthracite Coals : | |
| Best Big Vein Large | 30/- to 32/6 |
| Seconds | 24/6 to 27/6 |
| Red Vein | 20/6 to 25/- |
| Machine-made Cobbles | 35/- to 40/- |
| Nuts | 37/6 to 42/6 |
| Beans | 23/- to 27/- |
| Peas | 17/- to 18/- |
| Breaker Duff | 8/6 to 9/- |
| Rubbly Culm | 9/- to 9/6 |
| Steam Coals : | |
| Large | 17/6 to 18/6 |
| Seconds | 16/- to 17/- |
| Smalls | 9/9 to 10/9 |
| Cargo Through | 15/- to 16/- |

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

# French Engineering Notes.

*(From our Correspondent in Paris.)*

### Commercial Treaties.

THE carrying out of commercial treaties with Belgium, Switzerland and other countries has been rendered extremely difficult, and indeed practically impossible by the failure to pass the Tariff Bill. It hardly seems likely that it will come up again for debate until late in the year. In the absence of a stable minimum tariff it is almost impossible to enter into negotiations for commercial treaties, which have mostly come to a deadlock, with the exception of the treaty with Germany, and that country is guaranteed by a clause which gives it the benefit of any minimum tariff that may be in operation in December next. Therefore the Government has found it necessary to secure the passage through Parliament as soon as possible of a tariff limited to a certain number of goods for which insufficient protection is provided by the present minimum scale. There is an increase of duties all round, although it appears probable that, in many cases, the original Government proposals, which aimed at a much higher protection, will be modified and the new fiscal measure will lose much of its apparently prohibitive character. The duties to be established during the next few weeks will naturally be incorporated in the Tariff Bill later on. The British Chamber of Commerce in Paris has been complaining that the British Government has done nothing to hasten negotiations for a treaty of commerce with this country, but now that the French Government is hastening to get essential items of the tariff passed through Parliament there is hope that something will be done during the present year to prepare the way for better trade facilities later on between Great Britain and France.

### Colonial Works.

In view of the considerable quantity of material which this country is entitled to obtain from Germany on account of reparations it has been decided to utilise as much of that material as is necessary for the execution of public works, particularly in the Colonies, where a number of undertakings have been held up through the difficulty of providing means to carry them through. Madagascar will take 22,000 tons of rails and accessories, as well as metallic bridges and material for the equipment of ports. French West Africa claims material for the construction of railways on the Ivory Coast and in Dahomey, the latter to be extended to the Niger, and cranes and other equipment for the port of Dakar. German material is to be supplied to Indo-China for the Laos Railway, for the 550 kiloms. remaining to be constructed of the Transindo-Chinese Railway and for the Cambodian Railway. The total value of this material is about 800 million francs, and it will be supplemented by further orders for three railways in Madagascar, two in Indo-China and two in Senegal.

### Port of Casablanca.

The extensions which are continually being made to the port of Casablanca are justified by the growth of the phosphate industry as well as by the commercial and agricultural development that has followed the construction of railways with the idea of putting Casablanca into communication with the entire railway system of Morocco. The railways are to be electrified. Casablanca has now become one of the leading French ports. During the first half of 1927 the number of vessels entering it was 915, representing a gross tonnage of 1,923,218 and a net tonnage of 1,133,012. Of these totals French vessels accounted for 39 per cent. of the number and 53 per cent. of the net tonnage. The imports of coal increased from 77,243 tons in the first six months of 1926 to 112,096 tons in the first half of last year. There was also a much larger importation of railway material.

### Tidal Power Schemes.

The Minister of Public Works has given instructions to start at once upon the Aber Wrac'h experimental tidal power station. So far little has been done with this undertaking through the inability of the State to provide its contribution to the funds, and now that the financial difficulties are partly overcome active preparations are being made to push forward the scheme. It is in reality a private venture carried out with State financial aid and under State control, and it is intended to provide the Ministry of Public Works with the experience and data necessary to enable it to judge of the practicability of tidal power schemes for which concessions may be asked in the future. Rather unusual secrecy is being observed as to what is actually being done. As the enterprise is of an experimental character it is not likely that much will be made known concerning the works and future operations for some time to come. With the inception of Aber Wrac'h a good deal of interest has been taken in the utilisation of tidal power, and several schemes have been put forward, while for some years past American capitalists have sought to obtain concessions for the creation of tidal power stations on the Atlantic and Channel coasts. It is proposed to create one such station at Le Crotoy, in the Somme, where the bay will be closed in with a mole and divided in halves, with an arrangement of sluices and turbines in the mole that will ensure a continuous supply of energy.

### The Steel Trade.

The stronger tendency of the iron and steel trades is being maintained by the operations of the newly formed *comptoir* for the sale of girder and blooms and billets, and, although speculative buying has mostly ceased, the higher prices are being upheld and the industry appears to be stabilised on a basis more favourable to producers. Trade is steady without offering any prospect of special activity, unless the threatened lock-out in Germany should take effect during the week, in which event foreign consumers are bound to cover their requirements as much as they can in this and other countries. If the efforts of the German Government to settle the dispute by arbitration should fail the lock-out against the claims of the men for higher wages will affect 850,000 hands.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

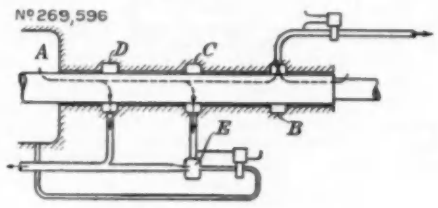
*Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

## TURBINE MACHINERY.

269,596. April 19th, 1927.—GLANDS FOR HIGH-SPEED SHAFTS, Aktiengesellschaft Brown Boveri & Cie., Baden, Switzerland.

The object of this gland is to minimise the loss of the working fluid from a steam turbine or air compressor A. The gland is

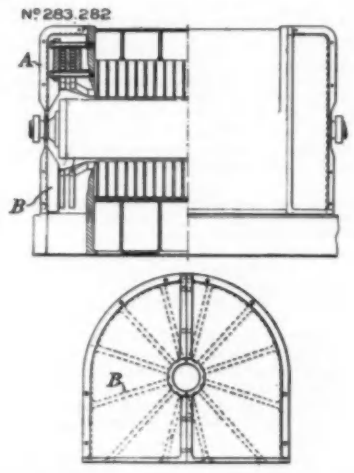



provided with three tapping places B, C, D. That at B communicates with a chimney and is maintained at a pressure below that of the atmosphere, so that air is drawn into the gland and goes away up the chimney. The tapping C is provided with an ejector E which forces any of the working fluid escaping at C and D back into the turbine.—*January* 19th, 1928.

## DYNAMOS AND MOTORS.

283,282. October 7th, 1926.—IMPROVEMENTS IN AND RELATING TO DYNAMO-ELECTRIC MACHINES, The Honourable Sir Charles Algernon Parsons and Jessel Rosen, both of Heaton Works, Newcastle-on-Tyne.

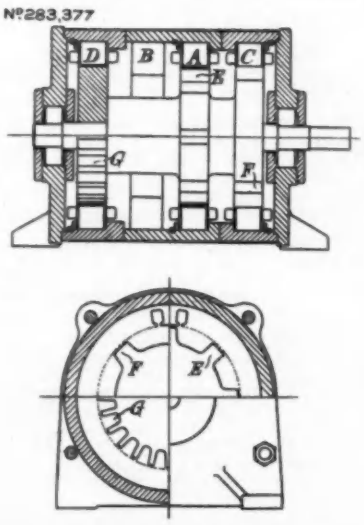
It has been found that the cast iron end shields of large electric generators cause an appreciable electrical loss resulting in a considerable rise of temperature, and the main object of this




invention is to eliminate this loss. The end shield A is made of wood, which may be treated in order to render it non-inflammable. Internal guides or baffles B may be arranged on the inside of the shield in order to stiffen the shield and to guide the cooling air through the windings. The specification also describes a modification of the invention.—*January 9th*, 1928.

283,377. April 7th, 1927.—INDUCTOR TYPE ALTERNATING CURRENT ELECTRIC GENERATOR, Frederick Newton, of Alfreton-road, Derby.

A triple frequency inductor generator constructed in accord-

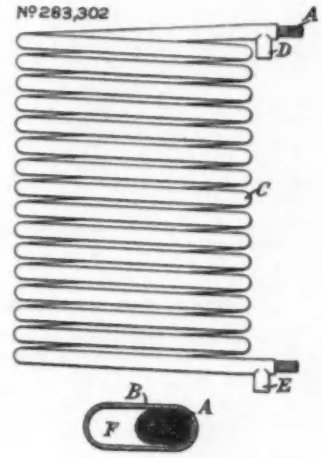



ance with this invention is illustrated. The armature A is built with slotted laminations, and the exciting winding is shown at B. Two extensions C and D are composed of armatures similar to that at A, and, of course, all these armatures have windings wound in slots. The armature D carries the sum of the fluxes of the armatures A and C. Two sets of polar projections E and F are formed upon the main body of the inductor, and a third set G upon an inductor extension. The number of inductor projections in this particular case are 8, 2 and 24. If the machine is required to generate a greater number of frequencies than three additional armatures may be provided on the yoke, and additional rings of polar projections upon the inductor.—*January 12th*, 1928.

## ELECTRICAL APPLIANCES.

283,302. October 25th, 1926.—IMPROVEMENTS RELATING TO ELECTRIC INDUCTOR COILS, George Edward Taylor and Electric Furnace Company, Ltd., both of 17, Victoria-street, London, S.W.

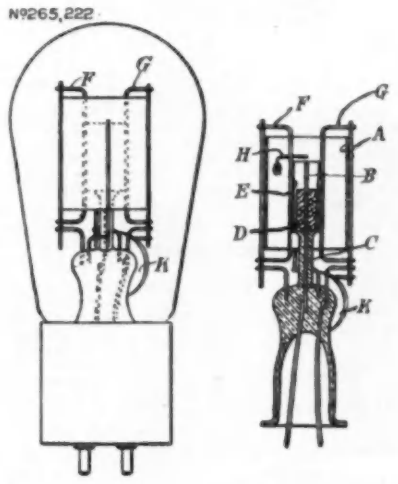
The induction coil described in this specification is suitable for electric induction furnaces working with high frequency currents. The stranded conductor A is inserted in a flattened tube B, and coiled into a helix C. Inlets D and E are provided for the purpose of supplying a cooling liquid to the space F.




The strands of the conductor are wound spirally. The rate at which heat is induced in the charge of a given furnace is dependent upon the ampère turns per unit length of the inductor coil, and the greater the ampère turns per unit length the higher the rate of heating. It is therefore desirable to keep the axial dimensions of each turn as small as possible, but with the ordinary form of coil this will tend to increase the resistance. The coil described has been designed to reduce the resistance and to overcome other defects.—*January 12th*, 1928.

265,222. January 28th, 1927.—IMPROVEMENTS IN ELECTRIC DISCHARGE DEVICES, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.

The object of this invention is to improve the efficiency of rectifiers having unheated electrodes of dissimilar area. The bulb of the rectifier contains a cylindrical electrode A, consisting of nickel, iron or other suitable metal. Within this electrode there is an anode in the shape of a rod B, which is surrounded by a glass sleeve C, and a sleeve D, consisting of alumina, above which the exposed part of the anode B projects. The function of the sleeve D is to shield the glass sleeve C from the electron and ion bombardment. Around the electrode B there is also a cylinder E consisting of nickel, which is connected to the cylinder A, by wires F and G, so that it is at the same potential as the cylinder A. A small wire H is mounted in the manner shown,



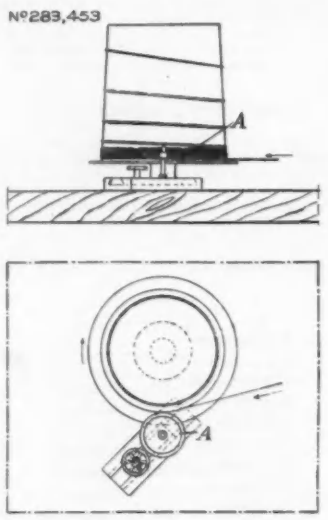

and extends inward, so that it is near the anode B, the object of this element being to assist in starting the discharge with a potential of about 10 volts. The bulb is charged with neon, helium or argon or a mixture of helium and argon at a pressure of about 5 mm. to 20 mm. Before the gas is introduced the bulb and metal parts are deprived of water vapour and other absorbing gases, and after the bulb is sealed a gas-absorbing agent is volatilised within the bulb. A metal capsule K, charged with a gas-absorbing agent, may be supported at some convenient place within the bulb. A charge of metallic calcium or magnesium may be placed within the capsule and volatilised by heating the capsule with high-frequency current. To reduce the starting potential a small amount of alkali metal, such as potassium, is introduced into the bulb. The principle on which this rectifier operates is described.—*January 19th*, 1928.

## MACHINE TOOLS AND SHOP APPLIANCES.

283,453. October 6th, 1927.—WIRE-DRAWING BLOCKS, E. Erdmann, Imhert, Westphalia, Germany.

In order to prevent the bunching of wire at the bottom of a wire-drawing block, and its consequent damage, the inventor provides a disc A at the base. This disc is slightly inclined to

the axis of the block, and is pressed up against it by a spring. It is claimed that this disc, on account of its inclined position, similar to a conveying worm, imposes an upwardly direct push

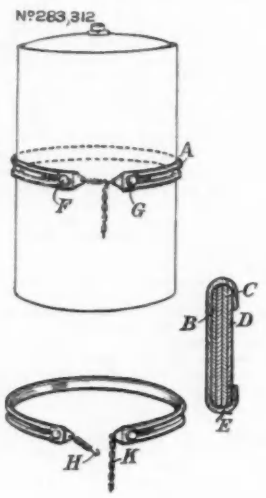



upon the wire, whereby the wire-windings are uniformly pushed upward, one winding in touch with the other.—*January 12th*, 1928.

### LIGHTING AND HEATING.

283,312. November 20th, 1926.—IMPROVEMENTS CONNECTED WITH ELECTRICAL HEATING ELEMENTS, Santon, Ltd., of 34, Bridge-street, Newport, Monmouth, and Harold Curtice Sanders, 18, Brynhyfryd-road, Newport.

The heating elements described in this specification is in the form of a belt which is placed in contact with the tank or other vessel to be heated. Within the metal casing A there is a resist-

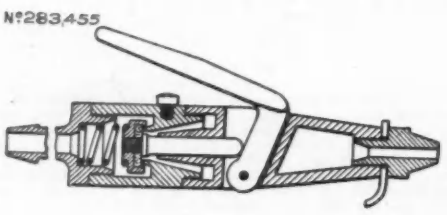



ance, and on each side of the resistance there are mica strips B C and a flexible metal strip D is placed against the mica. The edges E of the metal casing are turned over and pressed down to hold the resistance. The ends of the resistance are connected to terminals F and G. The device is held in position by the hook H, which is inserted into one of the links of the chain K.—*January 12th*, 1928.

### MISCELLANEOUS.

283,455. October 29th, 1927.—COMPRESSED AIR BLOW-OFF COCKS, E. Hartmetz, Oberesslingen a/N, Germany.

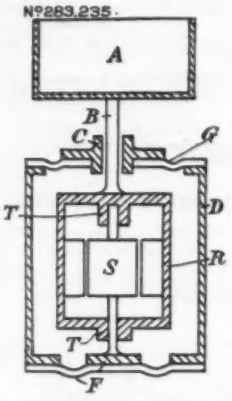
In this specification we are told that the use of compressed air for various operations such as blowing-off pattern plates, blowing out drill holes, blowing away turnings and the like is rapidly on the increase. The great disadvantage of the blow-off cocks hitherto used for this purpose is that they become non-air-tight in a short time, and thus a great deal of compressed air is lost. Further, a large amount of energy must be expended in




their operation, which soon tires the worker. All these disadvantages are, it is claimed, very simply overcome in the blow-off cock illustrated, by arranging the self-sealing valve longitudinally and not transversely of the blow-off cock, and by actuating the cock or valve by an angle arm or lever working on the end of the valve stem. The angle arm is guided and has its pivot and point of engagement in a longitudinal slot passing through the centre of the valve guide element so that on opening the valve compressed air flows through on both sides of the longitudinal slot.—*January 12th*, 1928.

283,235. July 9th, 1926.—JOURNALS FOR HIGH-SPEED SHAFTS, R. A. Baldwin, Woodley, Ashton-lane, Ashton-on-Mersey.

This invention is concerned with centrifuges, directly driven by electric motors. A is the centrifuge vessel mounted on the shaft B connected to the rotor R of the motor. The shaft B is carried in the main bearing C supported from the fixed casing




D by a flexible member G. The stator S is provided with a shaft journalled in bearings T and T in the rotor structure The shaft protrudes through the rotor and is connected by the flexible member F to the fixed casing D.—*January 9th*, 1928.

## Forthcoming Engagements.

*Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

DIESEL ENGINE USERS ASSOCIATION.—Caxton Hall, Westminster, London, S.W. 1. Report on Heavy Oil Engine Working Costs.

ELECTRICAL POWER ENGINEERS' ASSOCIATION: MIDLAND DIVISION.—Chamber of Commerce, New-street, Birmingham. Lantern lecture, "Modern Metering Practice," by Mr. E. Fawssett. 7.15 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: LONDON STUDENTS' SECTION.—Savoy-place, Victoria Embankment, London, W.C. 2. "Salesmanship and its Application to Engineering," by Mr. F. C. Dain. 6.15 p.m.

INSTITUTION OF ENGINEERING INSPECTION.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "The Inspection of Public Service Vehicles," by Major Vernon C. Brook. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, Westminster, London, S.W. 1. Informal meeting. Exhibition of industrial cinematograph films. 7 p.m.

INSTITUTION OF PRODUCTION ENGINEERS.—Society of Motor Manufacturers and Traders, 83, Pall Mall, London, S.W. 1. Paper, "Modern American Practice in Machining, with Special Reference to Broaching and Homing," by Mr. J. G. Young. 7.30 p.m.

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS.—Room D, Central Hall, Westminster, London, S.W. 1. Lecture, "Admiralty Floating Docks," by Mr. S. V. Goodall. 5.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecture, "The Applications of Electrochemical Deposits of Metals to Engineering," by Mr. C. H. Faris. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Mining Institute, Newcastle-upon-Tyne. Paper, "The Mitchell Crankless Engine," by Messrs. G. U. L. Sartoris and K. Watson. 6 p.m.

PHYSICAL SOCIETY.—Imperial College of Science, South Kensington, London, S.W. 7. Papers: "Some Methods of Estimating the Intensities of Spectral Lines," by Mr. W. H. J. Childs; and "Electrical Methods of Hygrometry," by Messrs. P. W. Burbidge and N. S. Alexander. 5 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "The Lives of Authors," by Professor George Gordon. 9 p.m.

WEST BROMWICH ENGINEERING SOCIETY.—Technical College, West Bromwich. Paper, "Power Factor and its Correction," by Dr. R. D. Gifford. 7.30 p.m.

TO-DAY TO FRIDAY, MARCH 2ND.

BRITISH INDUSTRIES FAIR.—Castle Bromwich, Birmingham, and at the White City, London.

SATURDAY, FEBRUARY 25TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, JUNIOR SECTION.—Winn's Café, Corporation-street, Manchester. Social gathering. 6 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Students' visit to the works of the Mullard Radio Valve Company, Ltd., Clapham.

MONDAY, FEBRUARY 27TH.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Cantor Lecture, "Fatigue Phenomena, with Special Reference to Single Crystals," by Dr. Herbert John Gough. 8 p.m.

TUESDAY, FEBRUARY 28TH.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "Flame Characteristics of Pinking and Non-pinking Fuels," by Professor R. V. Wheeler and Dr. G. B. Maxwell. 8.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—Visit to the works of Fescol, Ltd., Grosvenor-road, London, S.W. 1. 2.30 p.m.

SHEFFIELD METALLURGICAL ASSOCIATION.—198, West-street, Sheffield. "Practical Steam Measurement," by Mr. H. C. Armstrong. 7.30 p.m.

WEDNESDAY, FEBRUARY 29TH.

ENGINEERING GOLFING SOCIETY.—Institution of Civil Engineers, Great George-street, Westminster S.W. 1. Annual general meeting. 12.30 p.m.

INSTITUTION OF ELECRTICAL ENGINEERS: SOUTH MIDLAND CENTRE.—The University, Edmund-street, Birmingham. Paper, "The Transatlantic Telephone Circuit," by Mr. E. H. Shaughnessy. 7 p.m.

NEWCOMEN SOCIETY.—The Wellcome Historical Medical Museum, 54a, Wigmore-street, London, W. 1. Inspection of the Museum. 5.30 p.m.

NORTHAMPTON ENGINEERING COLLEGE ENGINEERING SOCIETY.—St. John-street, London, E.C. 1. Walmsley Memorial Lecture, "The Science of Air Compression," by Mr. W. Reavell. 4.15 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "Industry Fifty Years Hence," by Mr. Archibald Crawford. 8 p.m.

THURSDAY, MARCH 1ST.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Faraday Lecture, "Electricity in the Service of Man," by Dr. S. Z. de Ferranti. 6 p.m.

FRIDAY, MARCH 2ND.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—The Engineers' Club, Coventry-street, London, W. 1. Annual dinner.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecture, "Some Notes on a Recent Visit to the United States of America," by Mr. A. Abbey. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "The Psychology of the Sick," by Sir Farquhar Buzzard. 9 p.m.

SATURDAY, MARCH 3RD.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—College of Technology, Sackville-street, Manchester. Lecture, "Crystallisation in Non-ferrous Castings," by Professor C. H. Desch. 4 p.m.

MONDAY, MARCH 5TH.

INSTITUTION OF AUTOMOBILE ENGINEERS: WESTERN CENTRE.—Merchant Venturers' Technical College, Unity-street, Bristol. Paper, "Some Notes on a Practical Experience of the Single Sleeve Valve Principle," by Mr. G. L. Ensor. 6.45 p.m.

TUESDAY, MARCH 6TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "Automobile Steering Gear—Problems and Mechanism," by Dr. F. W. Lanchester. 7.40 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Broadgate Café, Coventry. Coventry Graduates' meeting. Paper, "The Problem of Selling Cars," by Mr. A. E. Collins. 7.15 p.m.

FRIDAY, MARCH 9TH.

PHYSICAL SOCIETY.—Imperial College of Science and Technology, South Kensington, London, S.W. 7. Thirteenth Guthrie Lecture, "Electrodeless Discharge Through Gases," by Sir Joseph Thomson. 5 p.m.

## CONTRACTS.

JOHNSON AND PHILLIPS, Ltd., of Charlton, London, S.E. 7, have just received orders from the Bay of Plenty Electric Power Board and the Thames Valley Electric Power Board of New Zealand, for a total of 163 outdoor type, three-phase distribution transformers in sizes from 5—25 kVA.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., have received an order from the Railways and Harbours Board of the South African Government for a powerful twin-screw tug for deep sea work at the Port of Durban. The machinery will consist of two sets of triple-expansion engines, which are to propel the vessel at 13 knots. The order was secured in the face of keen competition.

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. H. H. BROUGHTON, M.I. Mech. E., M.I.E.E., 33, Henrietta-street, Strand, London, W.C. 2, has been appointed agent for the British Empire by the Brünner Turbine and Equipment Company (Erste Brünner M.F.G.), Brno, Czecho-Slovakia.

THOS. FIRTH AND SONS, Ltd., of Sheffield, ask us to announce that the undertaking of Padley and Price, Ltd. (late of Sheffield), of Blackheath, near Birmingham, has been acquired by them. The undertaking will in future be carried on as Thos. Firth and Sons (Birmingham), Ltd.

THOS. W. WARD, Ltd., Sheffield, informs us that it has purchased for dismantling the blast-furnaces at Netherton, formerly belonging to Baldwins, Ltd. The purchase comprises two blast-furnaces with the necessary Cowper stoves and blowing engines. Both furnaces have been out of blast for some time.

THOMAS SMITH AND SONS (Rodley), Ltd., of Rodley, Leeds, ask us to announce that Messrs. Beard Huddart and Co., of Stockton-on-Tees, have ceased to act as their agents on the North-East Coast, and that Mr. Wm. R. Wheeler, of their head office staff, has now been appointed representative for that district.

MR. CHARLES LYALL MASON has been appointed a director of Cammell Laird and Co., Ltd., and also managing director of that company's Sheffield and Penistone Works. Mr. Mason previously held the position of divisional carriage and wagon superintendent of the London, Midland and Scottish Railway, and was in charge of the railway carriage and wagon shops of that company at Wolverton.

GARRARD GEARS, Ltd., asks us to state—with reference to the recent announcement that it had ceased to be a manufacturing company, and that its works at Cricklewood were being disposed of—that its business address will, in future, be 8, New-square, Lincoln's Inn, London, W.C. 2, to which it requests that all communications, other than inquiries for the supply of gears, should be sent. Inquiries regarding gears should be sent to Mr. C. G. Garrard, 76, Crouch-hill, London, N. 8.

BUILDING SCIENCE ABSTRACTS.—A new monthly publication of interest to all concerned in building construction and allied subjects will be placed on sale by H.M. Stationery Office within a few days. Its purpose is to provide, for the building industry, up-to-date summaries of the latest developments in the science and practice of building which are taking place throughout the world. Such a service is already provided for the members of other professions by periodicals, such as *Biological Abstracts* and *Chemical Abstracts*, and the Department of Scientific and Industrial Research has now decided to prepare for general circulation *Building Science Abstracts*. This has become possible partly as a result of generous support promised by the Institute of Builders. In this periodical all the more important articles appearing all over the world relating to building will be abstracted by the staff of the Building Research Station at Watford.